73 magazine
for radio amateurs

$1.00
January 1974
48768

A&W
1974 Catalog
Inside!

Cassette Code Courses

With these code courses from 73 the average person can learn the International Morse Code fast enough to pass the Novice or Tech exam in a few painless hours! One of the beauties of cassette tape is that you can take them with you anywhere – at work for lunch break – even in the car while you are driving. With the help of these tapes, you can pass the exam as easy as - one - two - three:

1 **Basic 5 WPM Code** – this cassette code course will teach the IMC at five words per minute, all letters, numbers and punctuation. The tape not only gives all these characters, but gives them in a very simple order so you can start copying code within one minute of hearing it. This has got to be the easiest way to learn code ever invented. The cassette actually has the code being sent at 6 WPM, allowing a margin for operator panic when the chips are down and the real exam is at hand.

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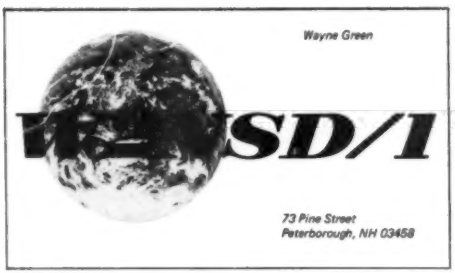

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73 magazine
for radio amateurs

#160 JANUARY 1974

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Getting rid of nothing.

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Our Cover. Sage Green, age 4, really digs two meter FM, even on horseback.

Note that the subscription rates are inching up a tad, and be warned that this is just the beginning. The post office and the paper biz are ganging up on magazine readers.

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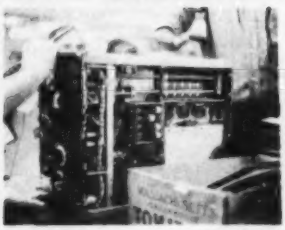
Amateur Radio

JANUARY MCMLXXIV — Monthly Ham



AUCTION ACTION

Auctions of ham gear bring out the scroungers, the builders, the cheapskates and the con men. The above pictures were taken recently at a typical New England auction . . . the Honeywell group in Billerica (Mass.) where long rows of tables were piled high with goodies. Where else can you get a Collins transceiver for $2 in good shape?

Just about everything imaginable in test equipment, surplus rigs, old ham gear, home made stuff, and microwave equipment went on the block. The buyers were gloating as they lugged away their prizes and the sellers had the satisfaction of cleaning out stuff that they no longer needed . . . and having some extra money to boot. Was that an IRS agent over in the corner making notes of the sales to check against next year's income tax returns?

The next big New England auction is scheduled for April 12th in Leominster where the Montachusett Amateur Radio Club will host at the Odd Fellows hall. Look for all sorts of things there, from bc radios to televisions, hi-fi, lots of test equipment (we bought a beautiful twin trace scope there at the '73 auction), ham gear, antennas, and etc.

Anyone who has been complaining about amateur radio being an expensive hobby should get to some auctions and change his mind.

Jeff Bishop W7CTX went one better when getting his new call letter license plates!

READERS GIVE US THE BUSINESS!

How about articles on antenna construction HF and VHF; legal actions, zoning, TVI, as applied to amateur radio; court decisions can set precedents which could be helpful to fellow amateurs . . . WA6HOB. (Excellent idea – any ham lawyers out there want to try an article or perhaps even a column? . . .ed). *More IC projects, 2M receiver using IC, and keep up the good work . . .* WB6QAM/1. *VHF (to 450 MHz) wattmeter; simple deviation meter; counter calibration hints; how about PROSE GOES bumper stickers for sale? . . .* WB6BLV. *I would like to see more in the Circuits, Circuits, Circuits section; a 220 MHz FM rig . . .* W7CWK. *More antenna construction articles. I like to experiment with new types of antennas. You have a great magazine . . .* WA5ZXG. *Keep up the good work . . .* W4RSE. *Keep coming with info and comments on FCC. Complex construction projects should have complete pc board drawings. Keep it up . . .* WN9KZO. *Great article about ham radio in Jordan, more, more . . .* WN1SIX. *Not particularly interested in Wayne's DXpeditions; good magazine . . .* SB5BNM. *How about an article on what each IC in the TTL 7400 does? . . .* SWL Hemmingway. *I'd like to see a detailed project for multi-channeling an HT-200 . . .* WA8ZWJ. (I wouldn't, so if you have one send it to ZWJ direct; gear's too old now . . . ed) *I am behind you in your fight with the FCC. It's high time that our government remembers that it's a government of the people, by the people and for the people, not the other way around. I am interested in simple, portable and cheap projects, particularly antennas, for the hf bands . . .* WN6UAI. *With all the TTL ICs, how about some good info on characteristic and uses of memories, 7000 series and others to adapt the TV typewriter of Sept. Radio Electronics to RTTY and other amateur uses? . . .* WB4DGR. (Okay

News Pages

with us, any authors out there? . . . ed) *If it takes sexy pictures to sell a radio magazine there must be something wrong with the radio magazine* . . . WØLFH. (No. not with the magazine, with the buyers . . . ed). *What about an ATV column?* . . . VE2BAQ. (Maybe . . . any volunteers? . . . ed). *Too much FM; more DXing articles; more IC projects, accessories for the ham station* . . . W6UFJ. *More two meter FM* . . . Hinckley. (Hey, get together with UFJ there . . . ed). *FB magazine; a few good covers, and few great covers* . . . Vaughn *Could use more operating hints for Novices* . . . WN2NUZ. *Too many articles have errors* . . . W1EOF. (Picky, picky . . . ed). *Congrats on your CW IC keyer, it looks like a first to me. Good job, keep it up* . . . W9MXJ. *Fine magazine. More on 2m FM* . . . W9NQM. *Let QST do the operating news. Keep hams pushing their congressmen and senators for repeal of strict 2m FM rules. It's starting to work* . . . K4AVQ/3. (Right! . . . ed). *Less DX news* . . . K3VOM. *Don't really see much value in reporting who worked whom on 50 MHz and other columns. I really enjoyed article on Wayne's visit to Jordan Need articles for people such as me who are trying to build repeaters* . . . WA3SWS. *I enjoy humor articles* . . . K3KAP (So write to Bob Manning and get him at the typewriter . . . ed) *I did not care for the trip to Jordan. More VHF and UHF construction projects such as antennas, converters, mixers, transmitters, amplifiers, using state of the art components* . . . WA6DJR. *Want complex construction such as digital counters, dvm's, quality test equipment. Some theory each month special intro to FM, RX and TX theory and a little math I've noticed that most authors drop the math which seems odd to me. Did you know that over 70% of all Americans under 50 have had at least one year of algebra, so why not speak the language the 70% can understand?* . . . DJØKM. (We suspect that 65% have already forgotten algebra . . . ed). *Your mix of HF, UHF and FM is fine. I enjoy the VHF and UHF articles. Also enjoy W2NSD talk on ham problems* . . . K1YLU.

NEW CODE TAPES OFFERED

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20 WPM CASSETTE

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13 per cassette . . . 60 min $3.95
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73 Magazine, Peterborough NH 03458

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	7.000– 7.150	7.150– 7.300
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	50.000–50.100	50.100–54.000
Advanced Class	3.525– 3.775	3.800– 4.000
	7.025– 7.150	7.150– 7.300
	14.025–14.200	14.200–14.350
	21.025–21.250	21.270–21.450
	28.000–28.500	28.500–29.700
	50.000–50.100	50.100–54.000
General Class	3.525– 3.775	3.890– 4.000
	7.025– 7.150	7.225– 7.300
	14.025–14.200	14.275–14.350
	21.025–21.250	21.350–21.450
	28.000–28.500	28.500–29.700
		50.100–54.000
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	7.100– 7.150	
	21.100–21.200	
	28.100–28.200	
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3.775– 3.890	3.845
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RESTRICTED COUNTRIES (don't work) are now down to only Vietnam(s) 3W8 and XV, with the exception of XV5AC being okay.

EDITORIAL BY WAYNE GREEN

POWER CORRUPTS

As Senator Long of Missouri said, after a subcommittee probe of the IRS, "IRS has become morally corrupted by the enormous power with which we in Congress have unwisely entrusted it. Too often, it acts like a Gestapo preying upon defenseless citizens."

The Senate hearing brought out that the IRS has stolen records, threatened reputable people, illegally tapped phones, criminally picked locks, defied court orders, spied on the mail of tens of thousands of citizens, illegally bugged phones, even booths, hidden microphones to hear taxpayers talk with their lawyers, and used just about every dirty trick in or out of the book to persecute those that it wants to screw.

If the end is accepted as justifying the means, then there might be some argument that, well, this is the only way we can "get" the leaders of organized crime. Unfortunately it is not organized crime that has been the subject of this persecution, but those least able to cope with it, the small businessmen. They are a lot easier to pick on and this means that promotions within the IRS are based upon the broken lives and businesses of these small people. In the IRS you either produce tax money or you get out.

The IRS has the power to confiscate everything you own, merely on the *claim* that you owe taxes. Once they claim, it is up to you to prove that you don't owe the money . . . at your own expense . . . which can be difficult when your bank account has been closed by the IRS. Your salary has been confiscated, and everything you own has been seized.

Secret IRS Laws

The income tax laws that you must obey with accuracy under penalty of heavy fines and imprisonment are not even understood by the commissioner who heads the Internal Revenue Service. These laws are so complex that no person can possibly understand them and no two agents can agree on them. The manuals of regulations and the volumes of official interpretations fill a bookshelf 33 feet long . . . the table of contents alone runs to over one thousand pages!

These books are so secret that the IRS will not permit a taxpayer to look at them . . . it took a court order to force the IRS to let a citizen even look at the table of contents!

Is it possible that the taxpayer is in the position of having to obey the rules in these books (or else!), yet is prohibited by the IRS from seeing the rules? That's the way it works. Not that mastering the enormous IRS bookshelf would do you that much good, for Congress is constantly changing the tax laws and the IRS is constantly writing more and more obscure interpretations of the laws. There are companies that try to keep up with the ever changing regulations and provide the information for tax lawyers, tax accountants and other seriously interested people who make this their life's work. But even these people, with all their investment in time and money trying to keep up with the regulations, are seldom able to agree. Where does that leave the poor average taxpayer?

When the income tax was started in 1913 the IRS took about 1% of the annual income. Now the IRS is the largest single item on the family budget, taking more than the cost of the home, car, food, or even the education of the children in most cases. How did the IRS grow so big and so powerful? It is a beautiful example of buresucracy out of control. Its secrecy and arrogance have grown with its omnipotence. The IRS is auditing you and your business, but no one is auditing the IRS. It has successfully avoided any serious examinations by Congress or even the General Accounting Office, the federal watchdog agency.

The taxpayer who has the guts to ask the IRS for details on a decision which affects him meets evasions, delays, and closed doors. If he pushes a bit he may find himself the butt of retaliation with year after year of hostile auditing of his returns. There is no question that the rule at IRS is if you make trouble for them they will make trouble for you . . . a whole lot of trouble . . . and it will go on just about forever . . . they never forget. In effect this means that practically speaking your tax is whatever the IRS agent says it is and you'd better pay up or else.

We Get Letters

The editorial in the November issue about the IRS brought in quite a pile of letters from amateurs who have suffered at the hands of these merciless "public servants." We'll print some of them, omitting the names and calls to prevent retaliation.

How It Started

Since the IRS is so secretive it is difficult to say exactly how the "case" against 73 Magazine got started, but despite the wall of secrecy there is no question now that a "squeal letter" triggered the original examination. There is little real doubt about exactly who sent in the squeal letter or why he did it. Unfortunately, though it is obvious, we can't prove it . . . so we can't yet publish the details.

As happens so many times in these IRS cases, the real reason for the attempt to screw 73 Magazine had nothing to do with taxes whatever, but was the result of a 73 publication which suggested some rough ideas on saving tax money. The story came out when an IRS agent who thought the whole thing stunk spilled the beans to a friend of ours . . . and the word got back.

Along in 1965, as I recall, I wrote a little booklet called "How to Make a Million Dollars." In it I pointed out that if making a lot of money was your goal, this was the easiest way to do it. There was nothing in any way illegal in the booklet, just the benefit of my years of experience. Toward the end of the booklet I mentioned that making the million was only part of the problem – then came the difficulty of trying to hold onto it. I admitted little knowledge of the tax laws, but I did suggest that a tax expert be consulted and that such would be well worth while.

The fact is that the IRS does not want people to consult tax experts. The IRS knows that most people overpay their income tax and they want it to stay that way. They know that the progressive tax goes on up to 94% of income and they prefer that the taxpayer be as ignorant of the tax laws as possible.

This booklet has so irritated the IRS that they decided to fix me but good. The IRS has a record of harassing writers, reporters and publishers who try to inform the public on tax matters or on the abuses of the IRS. They don't even like commercial tax preparing companies for these are generally in the business of trying to save their clients from overpaying their taxes. The IRS is opposed to the

(Continued on page 16)

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SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

I often receive inquiries on sources of filters for eliminating the bright blue initial trace on P7 Cathode Ray tubes used for Slow Scan, so here's a brief recap. The larger photographic supply outlets usually carry "gelatin" filters which are available in 10 inch sheets for 2 or 3 dollars. Since yellow is the opposite of blue on a color chart, it will filter blue and only very slightly affect the green (persistence). Kodak calls this a Wratten 15 G Filter. Also, Edmund Scientific Company of 300 Edscorp Building, Barrington, New Jersey 08007, has a nice filter in their catalog called "lemon yellow" which sells for about 2 dollars. Another source is advertising display stores and decoration suppliers. In the past, I've used two blank, evenly underexposed color film negatives (which are orange in color) taped together as a filter, and it worked quite well. However yellow would let more of the green persistence through. You could create a filter of any desirable color by adding ordinary cake coloring to a glass of water, then placing this in front of the monitor screen. By diluting the water you can vary the density of the filter. This idea may be handy for those of you working with color SSTV.

Another hard-to-find item is 50 or 70 degree yokes and focus magnet assemblies for those electromagentically deflected monitors. True, these can be a problem, but don't overlook naval surplus outlets, and the older TV repair shops. Often they have a storehouse full of early model TV's, which used these components, and will be glad to donate them to a worthy cause.

By now I'm sure most of you have heard the details about our sad 220 MHz rip-off. Although we as Slow Scan ops may not presently use 220 MHz, there was an aspect of Slow Scan research headed in that direction. This was faster scan rates, which would produce much higher resolution, but would require a greater bandwidth. (Some very interesting thoughts on this are presented on pages 216 and 217 of the 73 Slow Scan TV Handbook.) Since this bandwidth would be too large for low bands, but not wide enough to warrant 440 MHz use, 220 MHz was the obvious band for experimentation. However, one other possibility still exists and that is using a small portion of 10 meters for this "High Resolution Slow Scan". If those interested in such an endeavor would join together as a group and apply to the FCC for temporary permission for experimentation, the results might be surprisingly worth while (and might help preserve 10 meters from future "cuts"). If you become interested in these ideas, let me know and I will get a group list started and put all in touch with each other.

The annual world-wide Slow Scan contest is coming up on the 9th and 17th of February, and if all goes as planned this year will be the biggest yet. This year we are joining with *CQ Elettronica*, and 73 will be awarding certificates to the top scoring U.S. stations, while *CQ Elettronica* will issue awards to the world leaders. *I will be collecting only U.S. station logs for tallying, then forwarding them to Franco, I1LCF, for world tallying.* The 73 awards will be given from logs that I tally, so if you want in on the action, be sure to send your log to me. Remember, I will forward the scores to Franco (probably scores, not logs... overseas postage for a bundle like that is stiff).

Those of you who worked either HB9NL or HB9AIC on SSTV last October during their trip to Liechtenstein will be glad to hear they are QSLing 100% (especially those choice SSTV QSOs). Cards go directly to either HB9NL, Acklin Frank,

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November 1973

CH-6233 Bueron, Switzerland *or* HB9AIC, Herger Bruno, Wesemlinterrasse 8, CH-6006 Luzern, Switzerland. Good show, gang!

A very unique utilization of Slow Scan is materializing on the 20 and 40 meter bands in Cop MacDonald's New Directions Roundtable. This group gathers at 2000 GMT on 14.253 kHz and at 2230 GMT on 7163 kHz, both on Sundays. Slow Scan is used as an aid in presenting programs on some fascinating subjects and one soon finds himself studying the information presented on the screen, rather than just checking picture detail. I often tape the programs presented (which is 80% audio narration) and then listen back over them in detail on my cassette recorder while driving to work. Why not join in some Sunday . . . I think you'll like it.

Although I personally didn't make the Hyannis convention last September, I understand the Slow Scan development was very good. Cop MacDonald WØORX, presented an informative program on "Engineering of the SSTV Station" while Robert Suding WØLMD gave a presentation on Scan conversion and storage techniques. Robert also displayed his SSTV keyboard, which was a rollicking success. Venus Scientific was there with their new SS2 Monitor, and the first big showing of their fast to Slow Scan converter. Actually it is a form of Scan sampler; however, results obtained from the unit will prove fine. More on this later.

I've been putting off mentioning our poor band conditions for some months now, but it's beginning to look like things are going to stay this way a while longer, so don't despair – hang in there. (Often 20 meters is dead here in Alabama shortly after dark!) Surely conditions will improve soon and I'm sure we will find there will then be twice as many Slow Scan Stations and activity will again be tremendous.

Finally, I have an altitude correction on ATS-1, the weather satellite over Venezuela mentioned in the October column. It is 22,300 miles high, not 4000. Ditto ATS-3, whose location was somehow omitted. It is over the South Pacific, between Christmas Island and Hawaii.

. . . K4TWJ

For a
Socially Redeeming
message, write
P.O. Box 205,
Peterborough NH 03458

50 MHz BAND

Bill Turner WAØABI
Five Chestnut Court
St. Peters MO 63376

Late October brought several Es openings, which is very unusual for that time of year. The seasonal operators were missing but the regulars were on in force. W3QKV, WB9ETQ, W4GSD, W5BJJV and others were very much in evidence during the openings of the 17th, 21st and 24th. Bob WAØTXV tells me there were also several daytime openings during this period.

WB4OSN and W4GDS took advantage of the opening of the 24th to pass along preliminary information on a June contest DXpedition to 6Y5. Joe and Bob plus Jim K8BBN and others will be active from Montego Bay on 50. MHz and the hf bands during the week of the contest. They say "Hoppy" WB4BND won't be allowed to go along unless he gets married. I am afraid to ask why. Further details will be announced in a later column after the situation is firmed up.

I received a message via MARS from WA3EOP of the Itchycoo Park VHF Amateur Radio Club listing the dates of their annual "World Wide VHF Activity" as March 9th and 10th. I hope it's bigger and better than ever.

In a column last spring there was mention of a JA1 heard and recorded by WB4BVT. David lamented the lack of a callbook listing and wondered if someone had further information. As it turned out one of our readers "down under" reads and writes Japanese and has a copy of the Japanese callbook. He was kind enough to send me a translation which I forwarded to David in hopes he will be able to confirm reception. Unfortunately my filing system will not at this time produce the Xerox copy of the letter which puts me in the embarrassing position of being unable to thank the gentleman by name and call.

In the November column mention was made of signals heard on 50.158 by several stations in New England. Tom WB8KZD writes to say the signals heard were those of a Greek ship calling a Royal Navy station in Singapore. Evidently the signal was getting into the first (8.395 to 8.895 MHz) i-f of the SB-110. Tom also mentions a very useful book from which the above information came. About two years ago he bought a copy of the "Utility DXers Handbook" for $3.00. The address at that time was 401 Dewey, Evanston, Illinois 60202. I for one am going to order a copy.

Bob WB5ICJ has bought a Knight transceiver with a VFO and a groundplane antenna but reports having received only the local taxi. Is there anyone on AM within groundwave distance of Rayville, Louisiana who could get on and at least let Bob know his rig is working?

WB9ETQ of AT&R Inc., Wallace, Indiana, has designed a new 9-element wide spaced 6 meter beam which is being manufactured by Wilson. The gain is 19 dB, the front to back is listed as 45 dB (although Jack says his is over 50). VSWR is under 1.5:1 over the range 50.0 to 50.5. The boom is made of two 20' lengths of 2" tubing held together by a splicer. The elements are 5/8" in the center and reduced to ½" at the ends. The longest element is 118" – turning radius is 21' – wind load 4½ square feet. The weight is 35 lbs. I have personally heard two of these antennas "on the air" already and while I didn't have the opportunity to A-B them against another antenna I must say that in both cases the signal was outstanding. The price is $149 plus shipping.

.WAØABI

HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you are interested, send *73* your name, address and phone number. Don't be bashful – remember, it's always easier when you have someone to give you that added bit of confidence.

73 would appreciate amateurs and clubs looking this list over and helping whoever they can. Do you remember when you needed help?

Kirk Adamson
Rt. 2 Box 48
Elma WA 98541
772-2644

Owen Spencer
1332 Grant St.
Longmont CO 80501
219-866-7383

Alicia Moore
119 East Grace St.
Rensselaer IN 47978

Gus Browning W4BPD
Drawer "DX"
Cordova, SC 29039

Well so far I have not had any grumbling about the proposed "Super WTW", so I will get going on making up the DX spots we will count as "points" for this award. As long as possible I will try to steer clear from the word "countries" in this award, because we will most definitely be counting spots that is not really countries (is all those "places" on the DXCC "country" list "countries" ?-hi). So that some of you can start working towards your own Super WTW I will give you an "inkling" of some of the places will be. Every State in the USA, province in Canada, licenseing area in Australia, South Africa, oblisk in Russia, every island in the entire world (yes even Long Island, Catilina, each island in the Azores group, (or any other group of islands), their separation will not have anything to do with if they count or not in this award, just so they are actually separated. Every different nationality on the continent of Antarctica will count plus both the North Pole and South Pole, all this plus the usual DXCC countries and there will of course be other places added when the final list is made up and at times others will be added I am sure, because you cannot think of everything when its first being made up. We want this to be the Award to stop all other Awards ! Anyone who get to the top of our Super WTW can really say that he has Worked The World.

Now, to the regular WTW Award ! We are going to make some "adjustments" to our country list, adding a few here and there, and maybe some small changes in the rules. When I start printing the rules/score sheets for the new Super WTW, I will also print the same for the re-done WTW. May even try to combine both of them in the form of a small pamplet consisting of a number of pages which we will mail to those requesting an application blanks.

The DXing season is with us again and I hope the cold weather has not caught you with your antennas down. I warned you during all that nice, warm weather last summer to get with your antenna because it is not going to last too long.

Ten meters is again showing signs of coming to life since it was on a summer vacation last summer, and fifteen is going great guns. The lower frequencies are of course right in there because this is the kind of WX they love to propagate in.

If you chase DX (you must do it- you are reading this page) and want to really run up a score you are lucky. Not to many years ago you did this by listening hours and hours for that "new one", sometimes going for a few weeks to months later on when you had a sizeable score. These days there are numerous aids offered you, most of them at very reasonable charges. Quite a number of weekly, semi-monthly, and even a DX magazine. (that's mine !-The DX'ers Magazine). If you subscribe to all these you can work your DX almost effortlessly ! They will tell you who is active, what times of day they can be expected to come through, sometimes even they will tell you if it's long or short path. Plenty of good QSL info in most of them. In the form of DX tidbits you can get little sidelights about the DX that is active and actually on the air. You can find out about upcoming DX-peditions, when they can be expected to show up from their planned points of operations, the frequencies they plan to use and sometimes even their planned hours of operating, who will be their QSL manager (if they use that system of QSLing). And many other ways they can make your DXing a real "lead pipe" cinch if you read them carefully and make your DXing plans accordingly. You can get blank DX QSL cards to fill in yourself to send to that non-QSLing DX station (Ihave these on hand myself), and you can even get postage stamps (to glue on the above mentioned cards to use a good waterproff glue so no one can steam your stamps off ! Then now you are living in the day of the QSL Manager system of QSLing, and many DX stations have one of them and most QSL managers give you very fast service, then you get your cards fast ! Most of the cards come by air (especially if you send them a few IRC's. Naturally all these big, tall beams and those kilowatts make for better DXing the "easy way", too. About all I can say is: You modern DXers have it made if you use all the DX aids thats available to you. A lot different than when I was after DXCC certificate number 4 - which I finally made after beating my brains out, sneaking home during the day, staying up, sometimes all night. Oh yes ! You can get those DX stamps from W2AZX. He has stamps from most foreign countries. Then as another DX aid don't overlook such associations as the WWDXA; and then there are a number of "on the air" DX nets you can call in on after they say - "standing by for any non-member stations (or some other similiar instructions). Always remember the DX station is "running the show" and you play ball by his "rules" ! !

After reading the various propagation prediction boys charts and comments I have come to the conclusion that the present sunspot cycle is very very near its minimum, maybe it is a little past the bottom. They have to wait a while after the bottom has passed to be sure the spots are on the actual increase and not just a temporary thing. Lets all hope for the best because without those sun-spots the DX is just not there. But we have to admit that if the minimum has now passed it certainly didn't kill off all the DX because the past few years a lot of good DX has been worked We should know pretty soon now if we are in for more and better DX.

We now have someone living near Mount Athos. Our good friend W3CA has moved over there only about 25 miles from the Mount Athos border, in Greece. He has the callsign SY5MA and have been quite busy, giving out a new country to a lot of DX'ers. His QSL manager is W4KA.

A group of VQ9's from the Seychelle Islands made a successful DXpedition to the island of Farquhar a few months ago. Quite a number of thousands of contacts was made. To get from one island to another would seem to be a very simple task, but the business of getting a boat at a reasonable price can be a "lingering" thing that can stretch out for months. I know because I have "been there". The boat owners will promise you almost anything, and then they start the "putting off", till next week and if you stick with them you might eventually get to that other island. If you just want to stop by an island for a few hours or maybe ½ day or so it's easier, but when you want to be on the island for a few days or longer you have "problems". The various boats that go between the islands only make a brief stop at each island and they are wide apart stops, the next boat may be two or three or more months away. So don't be to critical of the delays in some of the plans of the boys over there. Things move slow on most of these islands and the boat owners are not an exception.

If you are a real "DX'er" you might start tuning between 14280 to 14290 kHz every day between the 2230 to 2400 GMT. The WWDXA meets there and you can get in on some good DX tips, even at times a good DX station may call in and work all those on frequency before he moves away (or to bed, or work, etc.)

We still need some WTW and later on our new Super WTW checkpoints. Maybe your club would be interested. Drop me a line for details please.

That's it for now, CU next mo.

TECHNICAL AID GROUP

The Technical Aid Group is a group of hams who have indicated a willingness to share their knowledge and skills with others. They have volunteered to be of service to fellow hams and do so without compensation. If you have a technical question, look over the list to see who has competency in the area of your question. For many of the TAG members, descriptions of all areas of expertise would be lengthy, so an abbreviated description is given. When stating your problem, give as much information as possible and clearly state the difficulty. Enclose a SASE for reply.

For those hams who have a desire to share, the TAG is the thing for you. Send a brief note requesting the membership form, fill it in and send it back. It asks a few questions about your qualifications, and there is a check-list to indicate your fields of competence. These cover all modes currently used by hams, antenna design and theory, transmitter and receiver design for HF, VHF, and UHF, logic, ICs, general help, and other areas. As more members are added, their names and addresses will be published.

Robert Perlman WB2VRW, 3 Josten Place, Hudson NY 12534. Electrical engineering student. Will help with Novice transmitters and receivers, and any help for beginning hams.

Thomas Laffin W1FJE, Box 133, Hillsboro NH 03244. Radio communications technician. Special aid to ex-CBers and those who need terms in easily understood terms; aid to Novices and Techs interested in MARS, RACES, CD, and CAP; how to build and scrounge parts; assistance on ham history, ATV, microwave, and general help.

Bill Daly WB8OQC, 1447 Old Salem Ct., Birmingham MI 48009. Works for Lafayette Radio. Specializes in 2M FM, solid state, VHF/UHF antennas, receivers and transmitters.

J. Bradley Flippin K6HPR, 116 Montecito Ave., Apt. M., Monterey CA 93940. Electronic engineer. Help with RTTY, data processing and programming, general.

Ira Kavaler WA2ZIR, P.O. Box 54, Flatbush Sta., Brooklyn NY 11226. Electrical engineer. Assistance offered in theoretical aspects of electricity and electronics from dc to UHF, design of equipment, computer programming, and signal circuit (failsafe) design.

John Teich WB2JAE/6 Ruddock, Cal Tech, Pasadena CA 91109. Novice and rig problems, solid state and logic circuitry.

David Felt WB6ALF, P.O. Box 261, Sierra Madre CA 91024. Electronics engineer. Qualified help in logic, digital and analog design, solid state, AM and TV.

Robert Groh WA2CKY, 65 Roxborough Rd., Rochester NY 14619. Communications engineer. Bob can lend a hand in HF and VHF transmitter and receiver design as well as solid-state logic and digital techniques.

Carl Miller WA6ZHT, 334 Paragon Ave., Stockton CA 95207. Computer technician. Carl's specialty area is solid-state QRP.

George Daughters WB6AIG, 1560 Klamath Dr., Sunnyvale CA 94087. Research associate. HF transmitter and receiver, SSB, and solid state, are George's fields.

D. Hausman VE3BUE, 267 Northcrest Pl, Waterloo, Ontario, Canada. Student. Novice transmitter and receiver problems as well as logic, digital techniques and ICs.

Hugh Wells W6WTU, 1411 18th St., Manhattan Beach CA 90226. Electronics instructor. Hugh can help with AM, Novice problems, VHF-UHF receivers and converters, solid state, test equipment, FM and repeaters, and general help.

Charles Hill WA7LQO, 4005 Campbell St., Baker OR 97814. Student. TV, Novice transmitter problems, and logic.

John Perhay WAØDGW, Route 4, Owatonna MN 55060. EE technician. John will help with RTTY, AM, SSB, Novice gear, HF transmitters and receivers, solid state, ICs, and test equipment.

Ron Thomas W8QYR/6, 1928 S. Beverly Glen Blvd., Apt. 12, Los Angeles CA 90025, tel. 556-2721. Commercial communications experience. Ron is willing to assist with beginners' problems, theory and regulations.

Jim Jindrick WA9QYC, 801 Florence Ave., Racine WI 53402. Consulting engineer. General help as well as HF, VHF, and UHF antennas, transmitters, and receivers.

William Welsh W6DDB, 2814 Empire Ave., Burbank CA 91504. Electronic engineer. Beginner's problems, code instruction, theory and regulations.

Ken Knecht W2GYF, Box 39, Clintondale NY 12515. Televsion engineer. TV video, logic, and digital techniques.

Tom O'Hara W6ORG, 2522 S. Paxson Lane, Arcadia CA 91006. Communications engineer. RTTY, TV, AM, SSB, VHF antennas, transmitters and receivers for HF through UHF, solid state, and general help.

Bruce Creighton WA5JVL, 2517 Metairie Ct., Metairie LA 70002. Electrical engineer. Antennas, Novice problems, solid state, logic, digital techniques, test equipment, and general help.

Tom Borok WB2PFY 215-33 23 Rd., Bayside NY 11360. Student. Tom is especially qualified to help Novices with their problems with transmitters and receivers, HF and VHF antennas, HF receivers, test equipment, and surplus, Morse code instruction.

Roger Taylor K9ALD, 2811 William St., Champaign IL 61820. Engineer. Roger is adept with AM, SSB, antennas, solid state, logic and digital techniques, ICs, test equipment, and other general help.

Orris Grefsheim WA6UYD, 1427 W. Park St., Lodi CA 95240. TV technician. Orris is capable of assisting in all fields of amateur work, DC through UHF, logic as well as Novice help.

John Allen K1FWF, 112 Edgemoor Lane, Ithaca NY 14850. Technical director. John's areas of assistance are VHF and UHF antennas, receivers, and transmitters, solid state and digital techniques. ICs, and SSB.

Eugene Fleming WØHMK, 1327 Prairie Rd., Colorado Springs CO 80909. Radio and television repair experience. Eugene will be glad to help with HF transmitters, receivers and test equipment. In addition to letters, he will accept open reel tape and braille correspondence.

Roger A. Baim WB9BDP, 2753 W. Coyle, Chicago IL 60645. Electrical engineer. Roger conducts Novice and General Class code and theory courses and will be happy to assist those seeking licenses.

73 REPEATER ATLAS REGISTRATION

REPEATER CALL (WR only)	FORMER CALL	LOCATION (City)	STATE

INPUTS	OUTPUTS	TT Wh TB PL	FM AM RTTY	AUTO PATCH	ERP	
		Hz				USEFUL RANGE (RADIUS)
		Hz				
		Hz				EQUIPMENT
		Hz				
		Hz				☐ SPLIT SITE ANTENNAS & HEIGHT ☐ DIPLEXER

REPEATER GROUP/SPONSOR	TRUSTEE	ID—TYPE OR MFR.

☐ I certify that I have received no outside assistance while completing this form.		
DATE	SOURCE (NAME/CALL)	SPECIAL OR EMERGENCY FUNCTIONS

CA	WR6ACU	Fresno	146.34–146.94
CO	WR0ACM	Denver	146.04–146.64 444.6–449.6
CO	WR0ACL	Denver	146.04–146.64 146.28–146.88
FL	WR4ADC	Daytona Beach	146.34–146.94
IA	WR0ABY	Clarinda	146.37–146.97
IL	WR0ABB	Chicago	223.34–224.94 443.6–443.6
IL	WR9ACK	Oaklawn	146.28–146.88
IN	WR9ACJ	Ft. Wayne	146.01–146.61
KS	WR0ACG	Topeka	146.34–146.94
KS	WR0ACH	Lawrence	146.15–146.76
NC	WR4ADS	Boulevills	146.34–146.94
NC	WR4ACM	Lenoir	146.25–146.85
NC	WR4ACJ	Mt. Airy	146.37–146.97
NC	WR4ADE	Reidsville	146.25–146.85
NY	WR2ACO	Flushing	147.69–147.99
NY	WR2ABO	Rome	146.28–146.88
NY	WR2ABV	Schenectady	146.46–146.94
NY	WR2ABZ	Troy	146.22–146.82
OH	WR8ABD	Cleveland	146.34–146.94
PA	WR3ACE	New Holland	146.91–146.61 223.34–224.94
PA	WR3ACD	Churchville	222.98–224.58
SC	WR4ADG	Conners Head	146.01–146.61
SC	WR4ABA	Columbia	146.28–146.88
SC	WR4ABB	Augusta	146.13–146.73
TX	WR5ABD	Dallas	146.22–146.82
WA	WR7ACB	Chehalis T1B5B	146.34–146.94
PANAMA			
	HP1PC		146.34–146.94

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

On October 15 this message was read over OSCAR 6, around every portion of the earth commemorating OSCAR 6's first birthday.

"This is an official bulletin from AMSAT concerning the sixth amateur radio satellite launched one year ago. After one full year of operation and over 4500 orbits in space, the AMSAT-OSCAR 6 spacecraft appears to be in good shape in spite of some battery degradation. It is expected that the satellite will continue to remain useable for some months to come. As the battery becomes weaker, it will be increasingly important that everyone cooperate in using the satellite repeater only during the scheduled ON periods. AMSAT maintains an OSCAR 6 Users List of stations successfully communicating through the satellite. The list now numbers over 1800 calls in at least 74 countries. All stations who have not yet reported their OSCAR 6 operating activity are urged to send their reports to AMSAT, Box 27, Washington, D.C. 20044. In return, you will receive an AMSAT-OSCAR 6 QSL card and a Satellite Communicators' Club Certificate. Work is now progressing on AMSAT-OSCAR-B, which is now approved for launch next spring.

October 15 marked the first-year birthday of AMSAT-OSCAR 6, amateur radio's newest and longest lifetime satellite in space. The spacecraft continues to operate successfully, having surpassed our lifetime objective of one year.

During its first year, it is estimated that on the order of 100,000 or more contacts have been made through AMSAT-OSCAR 6's two-to-ten meter repeater, and amateurs in at least 72 countries have been participating in this new mode of amateur communications. Experiments have been continuing in order to learn more about radio wave propagation and space communication techniques, and the American Radio Relay League and NASA are now working together to use OSCAR in the schools.

For many of us, the past year of satellite activity has been one of excitement, fulfillment and learning, as

CONCORD ½" VIDEO TAPE RECORDERS

Exclusive sale to licensed Amateur Only

–While they last–	NOW
½" VTR (was $1050)	$350
½" VTR/solenoid operated (was $1295)	$400
Service Manual	$ 10

SPECIFICATIONS

RECORDING SYSTEM: Helical Scan, dual rotating heads (long-life pressure sintered ferrite), 12in./sec., 30 frames/sec., 2 fields/frame. *VIDEO INPUT:* 1 volt p-p, 75 ohm unbalanced, composite video, sync neg. *VIDEO OUTPUT:* 1 volt p-p, 75 ohm unbalanced, composite video, sync neg. *HORIZONTAL RESOLUTION:* Better than 260 lines. *VIDEO AMP. FREQ. RESPONSE:* 2 MHz at higher than -6 dB. *SIG/NOISE RATIO:* Better than 40 dB. *AUDIO FREQ. RESPONSE:* 50–12,000 Hz. *POWER CONSUMPTION:* 80 watts. *RECORDING TIME:* 40 min. *DIMENSIONS:* 16½x16½x10 :. *WEIGHT:* 60 lbs. *ACCESSORIES INCLUDED:* Empty reel, monitor cable, power cord, splicing tape.

CONDITIONS OF SALE:

These video tape recorders are sold as new or factory reconditioned. Should any operating failure occur during the first 60 days after purchase due to manufacturers' defect, the VTR will be repaired or replaced at no cost to the purchaser (except shipping charges), by Concord Communications Systems of Jacksonville. Check with order. Shipped freight collect.

CONCORD COMMUNICATIONS SYSTEMS OF JACKSONVILLE

869 Townsend Blvd. Jacksonville, Fla. 32211
Attn: Jerry Anderson W4IQT

Watch for our ad next month featuring limited quantity specials on the famous Concord vidicon cameras including their hand-held 2/3" separate mesh view-finder camera. If you can't wait, call Jerry at
(904) 724-6844

well as discouragement at times. The sixth amateur satellite is another step toward the goal of an operational Amateur Satellite Service. As a learning experience, AMSAT-OSCAR 6 has taught us new operating skills, and through its faults (and our own) has shown us how to take the next step – and how to do a better job next time.

AMSAT-OSCAR 6 has verified our conviction that amateurs are capable of designing, building and operating long-lived communications spacecraft. It is an operational challenge as well as a design achievement to be able to successfully maintain the life of a spacecraft which has a total power budget of only three watts, for this length of time.

We are grateful to the National Aeronautics and Space Administration for making the launch of OSCAR 6 possible, and to the many organizations and individuals who have contributed either hardware, financially, or their personal time. It is only the total effort that has made the AMSAT-OSCAR 6 project a successful one."

Orbital Information

Orbit	Date January	Time (GMT)	Longitude of eq. Crossing°W
5539	1	0024.5	53.8
5552	2	0119.4	67.5
5564	3	0019.4	52.5
5577	4	0114.3	66.3
5589	5	0014.2	51.2
5602	6	0109.2	65.0
5614	7	0009.1	50.0
5627	8	0104.0	63.7
5639	9	0004.0	48.7
5652	10	0058.9	62.4
5665	11	0153.8	76.1
5677	12	0053.8	61.1
5690	13	0148.7	74.9
5702	14	0048.6	59.8
5715	15	0143.6	73.6
5727	16	0043.5	58.6
5740	17	0138.4	72.3
5752	18	0038.4	57.3
5765	19	0133.3	71.0
5777	20	0033.2	56.0
5790	21	0128.1	69.7
5802	22	0028.1	54.7
5815	23	0123.0	68.4
5827	24	0022.9	53.4
5840	25	0117.9	67.2
5852	26	0017.8	52.1
5865	27	0112.7	65.9
5877	28	0012.7	50.9
5890	29	0107.6	64.6
5902	30	0007.5	49.6
5915	31	0102.5	63.3

As a side note, amateur satellite communications have been internationally approved on:

7.0–7.1 MHz 144–146 MHz
14.0–14.25 MHz 435–438 MHz (A)
21.0–21.45 MHz 24.0–24.05 GHz

(A) This spectrum shared with another service; all others are exclusively amateur worldwide. Tele-command required on this spectrum.

...WB8LBP

LAKE COUNTY BANQUET

For the 21st consecutive year, the Lake County Amateur Radio Club, Inc., proudly announces its annual banquet. The date is February 9, 1974, and the time is 6:30 p.m., CST (we start on time). The place is The Scherwood Club, 600 E. Joliet St., Schererville, Ind. (two miles east of Rt. 41, ¼ mile north of Rt. 30). Chicken dinner – all you can eat – awards, fellowship, speeches, entertainment, gifts. Cost – $6.00 per ticket. Come. Bring your wife or girl friend. Tickets available from ticket volunteers or from the ticket chairman, Herbert S. Brier, W9EGQ, 385 Johnson St., Gary, Ind. 46402. Positively no tickets sold at the door!

Bill Pasternak WA2HVK/6
14732 Blythe Street #17
Panorama City CA

I suspect that most people would find the ambient noise a bit greater than they normally enjoy, but to my ear the sound of four powerful Pratt and Whitney engines is pure music. We are currently on board a gleaming white and blue bird heading toward New York at close to 650 mph. Flying in any of its varied forms has always been a stimulant to me and though I have flown many thousands of miles both commercially and privately, I always find it exciting. I guess that Richard Bach in his acclaimed book, "Jonathan Livingston Seagull" expresses this feeling in words that I could never hope to duplicate. I can only equate flight with freedom and freedom with flight. In my mind the two are inseperable. So here I sit at 38,000 feet above the terrain below sharing my feelings and the latest happenings in the southland world of VHF FM with you. It's time to continue on to the latter.

The longest running controversy in the Los Angeles area has been whether or not to permit a .34–.94 repeater. Since I have discussed the pros and cons of this situation at length in past issues, I wont go into them again at this time. However, in the past few weeks the situation has taken on a new twist, one that may eventually make a .34–.94 repeater out here a reality On October 21, the Southern California Repeater Association voted to open this previously unassigned pair for study of eventually putting a repeater on that channel. It must be emphasized that this is not a green light for anyone who wants the pair to go ahead and put his machine on the air. As Dick W6OLD explained it to me, at this time the SCRA will accept "proposals" for a repeater on that set of frequencies, and will study them to see if they meet certain parameters. These parameters have not been set yet, but I suspect that the next time the SCRA technical committee meets they will be worked out. As you can probably guess, reaction has been mixed within the local amateur FM community ranging from cheers to cat calls, but that was to be expected. Whatever the final action is on this question, we have definitely taken the first step in finally solving the .94 problem, and the SCRA is to be commended for its positive action. As I have said in the past, the SCRA is one organization that is going to make it. They are not afraid to think positive.

A new concept in supporting a repeater is being tried out here, and at the outset it looks as if it is going to be successful. The Mt. Wilson Repeater Association is unique in many ways, but its most outstanding quality is that it owns no repeater. It is strictly a user sponsored support group set up initially to supply operating capitol for the WR6ABE repeater and was the brain child of one of the ABE users, Bob Thornberg WB6JPI. It began late last March when K6OQK who owns the aforementioned machine announced that he had received permission to erect a new antenna system atop the tower they share with one of the local FM broadcast stations. Funds were needed fast to purchase a Stationmaster, duplexer and hard line. In his spare time, Bob set up a loose-knit organization that he named the Mt. Wilson Repeater Association, chiefly because the ABE repeater is located atop Mt. Wilson. One newsletter and a few weeks later, he had raised some $1200 and the new antenna with its associated equipment was recently installed.

An idea had been born; user support of a repeater that would not

interfere in any way with either the technical development or administrative decisions of the repeater's sponsor-owner. The users of ABE seemed to like it and this inspired Bob to continue the MWRA, still unofficially. In August, the organization sponsored its first social event; a Hawaiian Luau. Again this event was more successful than had been imagined by its sponsors. By this time the "unofficial board of directors" had grown to include Vic Lifland W6IWV and Russ Soloman WA6DUC. Finally, late in October, a meeting was held to in some way formalize the organization, and decide exactly what direction the organization should take. The outcome of this four hour meeting was the decision to keep the MWRA as it was, but dividing the responsibility for its operation among a number of people so as to take some of the lead off Bob's shoulders. It was also strongly emphasized that the organization was to function only as a social and support group and that all were left to its owner. As a matter of fact, it was decided that the MWRA would leave the door open to support other amateur activities ranging from a 40 meter CW to a 220 repeater. It was left to the members to decide the direction. Present plans call for a Christmas party, a day at Disneyland in January and continued support to WR6ABE. The future may hold far more interesting things though, in that such far-reaching ideas as chartering a plane for a mass vacation trip to Japan were also discussed.

Membership in MWRA is easy. All you have to do is show up one day on the WR6ABE repeater and you are a member. There are no monthly dues or yearly dues and the prime objective is deriving the most enjoyment possible out of our hobby. So, the MWRA, now an official organization with a president, veep and such, will continue and if things keep going as they have, it may well wind up as one of the largest repeater associations in the country. Heck, it already boasts WB2PQR in Brooklyn as a member, and Abe even attended the Hawaiian shindig. Not bad for a repeaterless repeater association.

Six meter activity in this area seems to be on the upswing. It seems that more and more people are pulling those Gooney Boxes, 99ers and alike, out of moth balls and firing them up. For those of you who have never operated six, it's a band that combines most of the attributes of two with a good deal more possibility of DX in the form of sporadic E and F2 skip.

It's also a great band for mobile and its only major drawback is in areas where there is a local TV station operating on channel two. As a matter of fact, I have yet to come across a sure all around cure for six meter TVI. (Actually the best method I found to date has been SSB. Not that it eliminates TVI, it just makes it a lot harder for you to be found by your neighbors carrying those kegs of tar and feathers). Well, let's face it, if we don't use six it may well go the way 11 meters went and you know about 220. This upswing in local six meter activity has given me the idea of a combined AM-FM repeater for the band and it may well become my next project. The idea is not new; two inputs – one AM, one FM and an FM transmitter. What better way to stimulate activity on six and at the same time introduce the world of FM communications and repeater type operation to those who may still not

73's WORLDWIDE SALES REPRESENTATIVES

U.S. AREA REPRESENTATIVES

New Mexico/West Texas

Ambrose G. Barry, W4GHV/5
1010 Juniper Avenue
Alamogordo, New Mexico 88310

Midwestern States

Gloria M. Ligon, K8WKE
47160 Condor Street
Utica, Michigan 48087

DX REPRESENTATIVES

BCN Agencies Pty. Ltd.
178 Collins Street
Melbourne 3000, Victoria
Australia

The Wireless Institute of Australia
478 Victoria Parade
P.O. Box 36
East Melbourne, Victoria
Australia

Carlos Rohden
Caixa Posal 5004
Sao Paulo, S.P.
Brasil

Jim Coote
56, Dinsdale Avenue
Kings Estate
Wallsend
Northumberland, England

Radio Society of Great Britain
35 Doughty Street
London WC1N 2AE, England

Short Wave Magazine
55 Victoria Street
London, SW1, England

Bryan Fogerty
Irish Radio Transmitters Society
9 Wellington Street,
Dun Laioghaire, Eire

Wireless Services, P.U.Sukhadia,
1/16, Shantinath Bhuvan,
427, Sion Road
Matunga, C. Rly.,
Bombay 19, India

Orion Books
13-19 Akasaka 2-chome
Minato-ku
Tokyo 107, Japan

Tama Electronics Co., Ltd.
Towa Building 502
515 Higashi Oizumi, Nerima-Ku,
Tokyo 177, Japan

Sun Electron Corporation
15–20 Takaban-1-chome
Meguro-ku, Tokyo 152, Japan

Kushal Harvant Singh
83, Aulong Road off Stephens Road
Kampong Boyan
Taiping, Perak, Malaysia

Gordon and Gotch Ltd.
P.O. Box 584
Auckland, New Zealand

G. H. Gillman
Smarts Road
Waikuku RMD
Rangiora, North Canterbury
New Zealand

New Zealand Assn. of Radio Transmitters
P.O. Box 1459
104 Hereford Street
Christchurch, New Zealand

Harold C. Leon
P.O. Box 61141
Marshalltown, Transvaal
South Africa

South African Radio Publications
P.O. Box 2232
Johannesburg, South Africa

South African Radio Relay League
P.O. Box 3911
Cape Town, South Africa

Julio Antonio Prieto Alonso, EA4CJ
Donoso Cortes No. 58
Piso 50, Letra B
Madrid 15, Espana (Spain)

All Europe,
except Great Britain & Ireland:

Eskil Persson, SM5CJP
Frotunagrand 1
194 00 Upplands Vasby
Sweden

be familiar with it. Your ideas on this subject would be greatly appreciated. Anyone have a spare mountain top they're not using in this area?

Below I can see the famous Verrizano Narrows Bridge and the vast expanse of the great city of New York. We are at about 3,000 feet and have slowed to about 180 knots. It has been a most pleasant flight and in about 10 minutes will come to an end when the man in the "front office" plants the mains firmly on "the numbers" at good old JFK International. It's a strange feeling seeing this all again, but more about this next month when "Looking West" takes a peek east. Time to fasten our seat belts. *Hello New York, HVK is back!*

...WA2HVK

CONTESTS

Tom DiBiase WB8KZD
708 6th Avenue
Steubenville OH 43952

CONTESTS

Jan. 15–17	OOTC QSO Party CW
Jan. 29–31	OOTC QSO Party, Phone
Feb. 9–10	Ten Ten International Net Contest
Mar. 9–10	Worldwide VHF Activity

THIS MONTH
OOTC QSO Parties

The CW Party is from 2300Z Jan. 15 to 2300Z Jan. 17. The Phone party is from 2300Z Jan. 29 to 2300Z Jan. 31. Complete rules and log sheets for SASE to G.G. MaConomy, W6BUK, Space 45, 36770 Florida Ave., Hemet, California 92343.

Results of the 1973 New Jersey QSO Party: Top four out-of-state: WA2FIQ/2, WAØTKJ, K1OME, WB2RKK/1. Top four NJ – WA2URS, WB2MVI, WA2EUO, WB2RJJ.

Results of the 1973 Illinois QSO Party: Top five out-of-state: WA3PWL/Ø, WAØTAQ, WB2HIL, W6MYP, W3ARK. Top five Illinois: WB9GFC, WB9HAD, W9LVH, WB9HHK, WB9JEP.

Results of the 1973 QRP ARCI Contest: Top ten: K8BHG, K8EEG/Ø, KØFRP/6, VE3KZ, WB4TNB, WBØDAV, W3ARK, K2MFY, W3RYV, WA8VPD. Closest race was for 8th Place with MFY edging out RYV by a scant 630 pts.

...WB8KZD

CX-7A NEWS

Ed Jay, the entrepreneur of Signal/One, is back in California, after some business in Sweden – and informs us that he hopes to again regain the right to manufacture the rig. The bankruptcy proceedings were held in late September. Ed says that owners should be careful about repairs on the rig – and to trust authorized dealers, but not much else. Don Payne has a good supply of parts and expertise. CX-7 books can be purchased from Thomas Advertising, Suite 210, 715 Silver Spur Road, Rolling Hills CA 90274. Ed mentioned in particular that some problems had arisen from CQ's buddy, Larry Pace, and CX-7 repairs.

K8NLM SERIOUSLY HURT!

A note from our very good friend Frank Warnock K8NLM brings us some details of his terrible accident at the Dayton Hamvention. Frank, who was the program chairman of the 1973 Dayton Hamvention Midcars meeting (and who arranged for me to speak to the Midcars people there) was getting things gathered up at the end of the meeting and the step going up to the platform turned as he did, throwing his back against the edge of the platform.

Frank was rushed to the hospital from the Hamvention and the diagnosis was a splintered vertebra with a crushed disc. He was in the hospital for two weeks – out for a while – then back for two weeks in June and two more weeks in July for an operation on the lower back. Frank is home again, but it will take a long time to heal.

Friends might drop Frank a QSL card at 1109 Graystone, Dayton OH 45427. Frank is a peach of a guy.

TWA SERVES

While on the way to Dayton the other day I was fed something containing water, hyrogenated coconut oil, sugar, soy protein, isolate, dipotassium phosphate, stearoyllactylate, salt, polysorbate 60, imitation flavor, beta carotene. What was I eating?

the TRAVELING Ham

Joe Kasser
1701 East-West Highway, Apt. 205
Silver Spring MD 20910

Some months ago I wrote about the cost of driving into New York City. WA2CUR wrote in with some comments. He writes that it can cost a bundle to drive into and around the area, but only if one takes the toll roads. He continues as to how to get around the toll roads as follows:

I-80 is about 98% complete and the rest of it should be finished off by the time this appears in print. I-280 was opened last July, I-78 is about 90% complete, the remaining sections to be completed are in the Newark area.

He says that if you drive into New York on I-78 (east) go STRAIGHT past the sign that says "local traffic only, take 287 to NYC–Newark." Do NOT take 287 to US-22 for New York–Newark, instead go STRAIGHT on 78. It is built for yet another 30 miles or so, and will save you a lot of time. At its temporary ending the way to US-22 is well signposted.

Going out of New York City on 78 West, you can apparently "sneak" onto the part that is open before the rest of the crowd, and also save a lot of time by getting off of US-22 before Plainfield and going up a mountain road on the right.This all takes place almost at the site of the Greenbrook 34–94 repeater.

Going south, I-95 is being rebuilt for free use. It is already open through to Philadelphia and crosses the Delaware for free. It will run through New Jersey up to 287 and then link up with the old I-95 (turnpike).

If you take the New Jersey turnpike south, you can get off about halfway down and take I-295. It runs parallel to the turnpike and has as many if not more lanes as the turnpike and is free. It also leads to the free bridge.

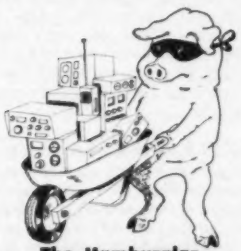
If you are going north to Connecticut. Massachusetts or New England areas, take 684 to 84. It is much better than I-95, is faster, has less traffic and has no toll booths. WA2CUR said that he made a few runs from NYC to Portland, Maine in about five hours and to Vermont in four hours taking 684 to 84 to 91, all free.

How about that, it just goes to show how they sock it to the out-of-towners. Thank you for writing in, WA2CUR, and anyone following these

instructions and getting lost, write to WA2CUR.

Changing the subject to more technical things, a QRP transceiver using a direct conversion receiver can be built using 8 to 9 transistors. Many designs have already been published for this type of rig. I have one and have already worked a thousand miles per watt using the breadboard version on forty. These rigs are cheap and can be powered off flashlight or car batteries. Could not some scheme be set up to build such rigs and send them to the developing countries to promote and encourage amateur radio? There rigs can be built for $10–$20 by the average ham. That is cheap enough so the traveler visiting such a country could use the rig during his stay, and then leave it there as a gift to the local club. Since the rig is so inexpensive, customs duties or entry taxes should be within reason and suitable crystals can be obtained on the surplus market at very reasonable rates for the simplest rigs. A further effect of propagating this technique will be that if the developing countries come on the air using QRP-CW rigs the use of CW will be given a shot in the arm and a real incentive for operating CW will exist. What do you think?

...G3ZCZ



The Hamburglar
STRIKES AGAIN!

List from Past Issues: Mfr., Model, Ser. No.	Owner	Issue
AF68 No. 10888	K5LKL	1/73
PMR8 No. 10818		
M1070 pwr supply		
Trio TR2200 No. 241988	WA2ZBV	1/73
Clegg 22er No. 1900-578	W1DHP	2/73
Standard 826M,No. 112007	WA8PCG	3/73
FM27B No. 27013-1141	W2LNI	4/73
FM-144-10L No. F459	WA8WOA	4/73
NPC 107m pwr supply 2, 5AJ-IPL Onan Gen., No. 327865		
R4B No. 115780	WA8GVK	6/73
T4XB No. 17801 G		
W4 wattmeter No. 8380		
Swan 250 No. F154806		
Swan ac pwr. sup. No. 0653566		
HR-2 No. 04-C2879	W6GSR	6/73
SB-34 No. 211828		
STD 826 No. 011288	WA2FSD	6/73
HT220 No. GJ7327	State Univ. of NY (Albany)	6/73
Yaesu FT-101 No. 82G12279/CW	W4GF	7/73
HR-2 No. 0302030		
Clegg 27B No. 72013-1068	W3BXL	7/73
Std. 826MA No. 208078	WB2DEW	7/73
Drake ML-2 No. 10582	W3MSN	8/73
Tektronics 453 Scope	WB2FZU	8/73
Sonar FR-2528 No. 21-4250	Doherty	12/73
Std. src-851-SH No. 9725		
Std. src-707C No. 2833		
TPL PA-6-IDE No. 1092		
RP MEA-22 No. 212		
Two Larsen antennas		
Swan 270 No. M-252616	W4NTB	12/73
Std. src-146A No. 208070	W7DKB	12/73

TOUCHTONE FOLLIES

HERE WE GO ROUND THE MULBERRY BUSH

4 4 4 2
Here we go round
2 6 6 2 4
the mul-ber-ry bush
4 8 8 8 8
The mul-ber-ry bush
6 2 4 4 4
The mul-ber-ry bush
4 4 4 2
Here we go round
2 6 6 2 4
the mul-ber-ry bush
4 8 8 6 8 4 4
So ear-ly in the morn-ing

AU CLAIR DE LA LUNE

4 4 4 0 6 8
Au clair de la lu-ne
4 6 0 0 4
Mon a-mi Pier-rot
4 4 4 0 6 8
Pret-e moi ta plume
4 6 0 0 4
Pour e-crire un mot
4 4 4 0 6 8
In the eve-ning moon-light
4 6 0 0 4
My good friend Pier-rot
4 4 4 0 6 8
Lend to me your quill-pen
4 6 0 0 4
Just to write a note

JINGLE BELLS

6 6 6 6 6 6
Jin-gle bells, jin-gle bells
6 # 7 8 6
Jin-gle all the way
9 9 9 9 9 5 5
Oh, what fun it is to ride
5 5 5 7 4 5 6
In a one-horse o-pen sleigh

OH, SUSANNA

4 8 6 6 9 6 8 7
Oh, I come from Al-a-bam-a
7 8 6 6 0 * 8
With a ban-jo on my knee
4 8 6 6 9 6 8 7
I'm goin' to Louis-i-a-n-a
8 6 6 0 0 4
My true love for to see
9 # 6 6
Oh Su-san-na,
3 2 1 2 3
don't you cry for me
4 8 6 6 9 6 8 7
For I come from Al-a-bam-a
7 8 6 6 0 8 7
With a banjo on my knee

QSL CONTEST

Robert Mielke WB6GEX wins the January QSL Contest with a design patterned after (he can't fool us) the California Freeway system. Win a one year subscription to 73! Send your entry to: QSL Contest, 73 Magazine Peterborough NH 03458.

QTH CHANGE?

To be absolutely sure that 73 will follow you to your new QTH, try to notify our Subscription Department at least 8 weeks in advance of your move. Please include your old address and call as it appears on your current mailing label — or better yet, send the label itself.

OLD ADR (or mailing label)

NAME_____ CALL _____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

NEW ADR

NAME_____ CALL _____

ADDRESS_____

CITY_____ STATE_____ ZIP_____

(W2NSD/1 cont. from p. 4)

whole idea of saving these dollars and has been making life miserable for the larger income tax companies

Painless Taxes

Since most income taxes are withheld by the employer, they are money that we never see and is unreal to us. Our take home pay is our real pay and that is all that we feel that we are paid for our work. The much larger number is some sort of bookkeeping figure and not real. This is a great system for the IRS for it hides the ugly fact of their taking money out of our pocket quite effectively.

If the old system of paying up income taxes at the end of the year was reinstated you can bet that a lot more people would be uptight about the enormity of the tax bill and would raise hell with their Congressmen about both government expenses and the IRS ways of collecting them.

For instance, take the short form of reporting at the end of the year. Tax experts estimate that this dupes millions of people out of legitimate refunds that they would otherwise get. It is painfully obvious that the IRS not only wants to keep this money that was overpaid, but will go to great lengths to prevent tax firms from helping people to get back what is rightfully theirs.

A Book is Needed

The horror stories of innocent people harassed and crushed by the IRS are so numerous that it would take a fair sized book just to scratch the surface. Thousands of people get a screwing every year and some cases are so blatant that it is a national disgrace. The press for the most part is terrified of the IRS and cooperates by refusing to publish their stories. The courts go along with the screwing through the fear of the judges and the inability of most taxpayers to defend themselves once the IRS has shut off their credit. It is a dirty story and it needs to be told. Congress must be awakened to this situation.

IRS NEWS

The November editorial mention of the IRS and its sometimes questionable actions brought in considerable mail and phone calls. . .all complimentary.

One reader told about the time that he had been running a small business and suddenly got a visit from the IRS with a demand for immediate payment of the company's quarterly payroll witholding account. No pay would mean that the paddlock would go on the door right then!

Our hero explained that he had paid the account on time, had the cancelled check to prove it, and had already sent in copies of the check as proof that he had paid, in addition to a second check with a penalty payment sent in protest. It was difficult to believe that after paying the bill, re-paying it with an alleged penalty, and including a copy of the original cancelled check that the IRS was ready to close his business down.

Eventually he got back the two extra payments and the fines. You can bet that this is one chap who has little use for the IRS people and the way they throw their weight around.

GIVE 'EM HELL

One of the responses to the November editorial on the IRS persecution complex was from a newspaper which wanted to reprint the piece. Fine . . . no, great! The more people who know what these scoundrels are doing the better. The way to fight an intrenched bureaucracy like this is with truth . . . and to get Congress to put the brakes on.

If you have any local paper that would like to run this series or any part of it, we have edited copies available to them which leave out the business about 73 Magazine which would only confuse the general public. This series is available at no charge and will continue until the case against 73 Magazine and Wayne Green is settled. There is enough data to fill a book already, and readers are pouring in more every day.

Let's help make this country safer for the small person and not just for the rich . . . let's get the facts about the IRS and their dirty work out where it can be seen.

NEW BAND AVAILABLE

As the last few holdouts on two meter AM move on up to the FM end of the band the lower two MHz is developing into a wasteland. Experience has shown us that as soon as anything like this has remained unused for a short while there are vultures just waiting to swoop down . . . a la the CB proposal for amputation of the 220 MHz ham band, starting first with the top MHz.

Unless some way is found to get Walker to back down on his firm resolve to limit repeaters to the top two MHz and no more, the repeater channels will inexorably grow more and more crowded and the rest of the band more and more deserted.

Obviously something will have to be done about this.

It may be that the concept of simplex channels within the repeater allocation of the band is a luxury that will have to go by the boards. Up until the freeze on new repeaters, courtesy of the paperwork curtain raised by Walker, several repeaters were starting to edge into the channels held back for simplex .most of them using a one MHz split, and most in areas where the 27 normal repeater channels were already in use or spoken for.

Obviously it is possible to start using frequencies below 146 MHz for FM simplex communications. The Amsat band has interfered with this a bit with its no-man's land request for the 145.9—146 MHz segment.

Perhaps it is time to rethink the possibilities of permitting some narrowband television experiments — perhaps with a 100 kHz limitation. There are several techniques that are being developed and they should have a chance to be worked on over the air. Limiting them to 450 MHz has kept any practical development from emerging.

Some years ago a petition was put into the FCC for such experimentation on two meters. The ARRL bitterly opposed it and the FCC went along with them. The main result of this is that there is not yet a narrowband television system. Many amateurs who have done exploratory work in this field are certain that a true narrowband television system can be devised which will permit fast scan television, perhaps even with color, within a 100 kHz bandwidth! By opening some frequencies in the two and/or six meter bands, this breakthrough might be brought about . . . and again amateurs will have contributed to the communications art.

Perhaps you have an idea for some use to put the unused half of the two meter band?

ANOTHER REPEATER SERVICE

A note from W1RAP suggests that a special receiver be set up at repeater sites tuned to the aircraft emergency beacon channel of 121.5 MHz and that some system be added to the repeater so this channel can be monitored when a plane is reported missing.

This would seem like an extremely valuable service.

It might be worth while to have the output of the beacon receiver actuate a low level tone on the repeater which would tell all users immediately that a signal was coming in on the emergency channel, but would still permit the repeater to be used normally.

Such a service could have expedited the discovery of a recent crash just a couple miles from the WR1AAB repeater site. When a plane goes down every minute wasted can be critical in bringing help to the survivors. If we were back in the old days when experimentation and innovation were encouraged by the FCC, I'm sure that many repeater groups would go far

beyond a mere warning system and probably evolve a system which would pinpoint the direction of the crash from the repeater. Two repeaters in one area could quickly provide the coordinates of a crash in this way.

Our repeater sites are ideally located for this service and, if we can get the Walkerules eliminated, our repeaters will be back on the air 24 hours a day, which would be important for an emergency aircraft warning detector system.

If any repeater group does set up a warning system, please be kind enough to let 73 Magazine know about it... and we'll in turn make sure that this news gets to congress, where it will do us some good. 73 is your *only* channel to congress.

JOB OP

Catch-22 in the publishing biz is that you have to have experience to get a job – so how do you get the experience so you can get a job? This is a tough one for publishing is a high pay biz and worth the effort.

One way to get on this gravy train is to find a small remote publisher and hire on for peanuts to get your experience. If you make the most of the opportunity you can come out of it with a salary well up in five figures – and that's nice. The big magazines desperately need people who really know the biz and can produce results. Ad salesmen can name their own price. Circulation managers do well too, etc.

Which brings us to some openings in the 73 staff for people to learn ad sales, circulation, layout and pasteup, assistant publishing, and things like that. The growth of 73 plus the work required on the new magazine that is being started in a couple of months means that more people are needed.

And where better to work than New Hampshire? It's fantastic.

Call Yvette WA8ULU at 603-924-3873 if you think you might like to give it a try.

WHY YOU GET CALLED

What to do when the FCC calls you up for re-exam

The FCC has been calling up Techs and Conditionals in fair quantities all around the country. This appears to be another move by Walker to harass the troops and implement punishment licensing.

When the letter arrives you have 30 days to get yourself ready for the confrontation. With a little work you can be ready for them, so don't despair and just give up without even trying. It just isn't all that difficult.

First of all you'll want to be sure that you can breeze through that code exam... and that's the one that throws the highest percentage of applicants. If you are able to copy the 73 Magazine six words per minute cassette code practice tape, the Back Breaker – 6 (BB-6), you'll have no problem at all with the 5 WPM stuff. At $3.95, this is a must. Conditionals will want to get the BB-14.

One beauty of these cassette code tapes is that you can practice during time that might otherwise just be wasted such as while you are driving to and from work, at lunch or even coffee-break. If you have any wasted time... in line... in waiting rooms... buses... planes... trains... or a dull job with time to spare, your little cassette tape player will be worth its weight to you.

Now there is the matter of the written exam. It doesn't do you any good to breeze through the code if you are going to make a mess of the theory. You should know by now, hopefully, that 73 Magazine has a series of four license study guides available, one for Novice, one for General, one for Advanced and one for Extra Class license exams. There are the only books available which cover all of the material you'll need to know. They are the only books that are up to date. The fact is that the FCC has recently rewritten their exams and this has made most study courses completely obsolete... except the 73 series... and the reason for this is that these are the very books used by the FCC to prepare the new questions!

The 73 study courses are different... they teach you the theory logically and systematically rather than just expecting you to memorize questions and answers. Q&A books are ok as long as you get the same Q's... which you probably won't.

The investment of $6 for the General Class study course and $4 for the code cassette are little enough for the peace of mind they give. If you give these two aids a chance there is no way you can fail that exam. And, at $9 a throw, it is worth a bit of an investment to make sure that you get through the first time. Who wants the embarrassment of flunking out? It makes it look as though you cheated when you took the mail order exam... so be prepared.

It might be prudent to order your book and cassette course right now rather than waiting for the axe to fall. If you wait, you could have only 30 days to get ready and you'll be nervously waiting for the post office to get your stuff from 73 Magazine to you, which could take a couple of weeks, the way things have been going... leaving you precious little time to get ready for the beady eye'd FCC examiner.

The amount of time it takes to be sure of passing the exam is so slight compared to the years of fun you can have with amateur radio that it is very well spent. A few hours of study and code practice can pave the way for a lifetime of fun. So make the study as easy as you can for yourself with the 73 study guides and cassette code courses.

73 IN THE QSL BIZ

After looking over the QSL price lists and doing a lot of close figuring, it was decided that 73 might be able to pull out really nice first class QSL cards for a lot less than they are available from most printers. Of course 73 has the advantage of having the latest in typesetting equipment, a professional phototypositor, an art department, a complete darkroom set-up, and an in-house printing department.

Three cards were designed and the first ad for them ran in the October issue of 73 on the back cover. The response was immediate and heartening. Hundreds upon hundreds of orders came pouring in.

The extremely expensive and very difficult to find heavy weight Chromecoat paper had been ordered before the ad came out, but with paper in short supply the delivery kept being put off, week by week. Eventually the truck pulled up with the big box of paper. The excitement was short lived when it was discovered that one end of the box had been broken in shipment and much of the paper ruined by water. Back it went.

A replacement box of paper eventually arrived and the team got to work catching up with the QSL orders. By this time the art department was deeply involved with getting the December issue ready for publication, so another week went by before they could get cracking.

Once December was done they got the artwork ready for the cards. First came the picture of the world in blue. Since ten cards were going to be ganged up on the press to keep the cost low this meant making ten negatives of the world and putting them in place for the blue printing plate. Biff Mahoney, the head of the printing department, ran off the blue printing, then the QSO information data on the back of the cards. This info was set on the composer, pasted up by an artist, and shot into ten negatives on the big process camera, stripped into the final position, and the printing plate made by a photo process.

The call letters for each card were set with a photo typositor and pasted into place on a large dummy sheet so they would appear exactly in the right place on the ten cards later on. Then

Caveat Emptor?

Price – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order.

Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.

Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.

We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.

For $1 extra we can maintain a reply box for you.

We cannot check into each advertiser, so Caveat Emptor . . .

ACTIVE HAMS – monthly mailer of reconditioned and new equipment specials. Sell – buy – trade. Write: Associated Radio, 8012 Conser, Overland Park, Kansas 66204. Call: 913-381-5901.

FREE BOOK About Digital Logic and Computers, and how you can design and build your own. EEW, Box 8204-CC, Pittsburgh PA 15217.

"DON AND BOB" discount prices plus full warranty. Call or write fast quotes. All items new, guaranteed. SBE144 199.95; Midland 13500 2MFM 15W mobile 219.95; 13509 W-T 2W. 209.95; SBE450TRC, converts 2M-3/4M 149.00; 20% plus off list: Hygain TH6DXX 143.00; Mosley Classic33 124.00; Ham-M 99.00; TR44 59.95; Belden 8wire rotor cable 8448 10¢/ft; Hygain 400 rotor (230.00L) 179.00; 5cond. rotor cable 19¢/ft; 15% off list Triex, Rohn tower; 3/16" cable clamps 18¢ ea; No.15 antenna wire 1.95/C; Motorola HEP 170 epoxy diode 2.5A/1000PIV 29¢, 25.00/100 lot; .001MFD/10KV doorknob (CDE) 1.95; Hammarlund HF50 1.95; Motorola semiconductor data series 7.50; Sorensen ACR2000VA AC regulator 150.00; write quote Swan, Eimac, Drake, Kenwood, Tentec; Calrad KW SWR-relative power dualmeter bridge, to 150MHZ 15.95; all items guaranteed. Free flyer. Prices fob Houston, include postage with small orders, excess refunded. Madison Electronics, 1508 McKinney, Houston, Texas 77002. 713/2242668 nite/weekend 713/4975683.

COMPLETE STATION: First $350 takes Heath SB-101 with Xtal Filter, AC Power Supply, SB-600 Speaker, SB-640 LMO, Astatic 10-D P-T-Talk Mike. Hustler Antenna with 80 Mtr. Coil. WA2MQI – Glenn Commons, 12 Yorktowne Court, Princeton-Junction, N.J. 08550.

EQUIPMENT FROM 73

The following list of gear, unless otherwise noted, consists of brand new equipment purchased for testing purposes only. Some have been tested, some remain unopened in original cartons. We are offering this gear at a considerable discount on a first-come-first-served basis. Please send Money Orders or Certified Checks only to 73 Magazine, Peterborough NH 03458.

Cap Com 40M solid state SSB xcvr	$150.00
Gladding 12V power supply	$60.00
SBE Scanavision	$650.00
Midland 13500 2M xcvr	$200.00
Midland 13509 220 xcvr	$200.00
Tempo CL-220 220 xcvr	$200.00
Clegg FM-21 220 scvr	$255.00
TME-H-LMU 16 channel rcvr	$255.00
Digital logic-clocks	$80.00
Dycom 2M repeater	$425.00
Wilson 7 element 10 and 15M beam pick up only	$250.00
Waller 60A power supply	$105.00
Robot Monitor	$265.00
Robot Camera	$265.00
Pickering KB-1 keyobard	$200.00
TPL 502-B 2M amp 1W/40W	$110.00
TPL-5022M amp 10W/45W	$90.00
Heath HWA-202-1	$30.00
Heath HA-2022 amplifier	$70.00
Gladding 8 channel scanner	$110.00
Gladding HI Scan	$150.00
Regency TMR-8-U Scanner	$140.00
Tempo fmh charger	$25.00
Heath FM-2102 wattmeter	$30.00
GTX-2 FM rcvr	$225.00
Newsome 2M KW amplifier	$350.00
Heath IC-2009 calculator	$90.00
SBE 450 FM xcvr	$340.00
Mits calculator with ac adaptor and case	$130.00
Memory Matic 8000	$320.00
IC-30	$450.00
IC-60	$400.00
RP Synthesizer MFA 22	$225.00

HEATHKIT SB-102, CW filter, AC and DC suppplies, mobile mount, remote LMO, speaker, manual, asking $475. Heathkit SB-110, AC supply, speaker, manual, $225. Also Hallicrafters HA-1 keyer, $50. All good condition. John Boston WB4RUA, Box 354, Calhoun, Georgia 30701. (404) 629-3048.

WE BUY – late model Collins-Drake-Swan. Top prices cash. Associated Radio, 8012 Conser, Overland Park, Kansas 66201. Call: 913-381-5901.

GOOD NEWS – The SRRC Hamfest June 2, 1974 at fabulous new site in Princeton, Illinois Fairgrounds. SRRC/W9MKS, RFD No.1, Box 171, Oglesby, Illinois 61348.

FOR SALE – Pearce-Simpson Gladding 25 Fully equip with crystal's for $189.00. G. Smith, 340 Granville, Bellwood, Il. 60104.

HALLICRAFTER, HT-33A, 1KW Amp. $225. SX-101A with Product Det. (Factory Sch.), $175. Both mint, with manuals. W1JSS. 617-762-5252.

GREATEST of them all! That's the ARRL 1974 National Convention, sponsored by Hudson Amateur Radio Council. Remember the dates – July 19, 20, 21 at the Waldorf-Astoria, New York City. Three days of exciting events!! Wide array of demonstrations, exhibits and forums featuring latest in FM, SSTV, ATV, RTTY, FAX, Satellites, Antenna design, Transistors, Integrated Circuits, DX, MARS, ARPSC and much more. Something to do every exciting minute for YLs & XYLs – Tours, New York sightseeing, visits to popular TV shows, Parties, Fashion Shows. Meet the ARRL President, Vice-presidents, and all 16 Directors! Famous-name Speakers at Saturday Night Banquet! Everything for the Non-Ham, New Ham and Old Timer. For Info, Contact: ARRL Convention, 303 Tenafly Road, Englewood, N.J. 07631.

SB-34 SIDEBAND TRANSCEIVER 75-15m, built in AC/DC supplies plus never used mobile mount. Total operating time on rig near 20 hrs., almost brand new! Sorry, no microphone. $225. Ron Subka WA9FPP/1, Russell Station Rd., Francestown NH 03043.

HAMMARLUND SP-600 "Super-Pro" 0.54–54.0 MHz $260. AN/FRR-59 Digitally-Tuned Receiver 2–32 MHz $700. Free delivery within 75 miles. Alan Frisbie, 381 Prospect, Cambridge, MA 02139. 617-547-7652.

CALCULATOR OWNERS: Use your +-x÷ calculator to compute square roots, trigonometric functions, logarithms, exponentials, and more! Quickly, Accurately, Easily! Send today for the improved and expanded edition of the first and best calculator manual – sold throughout the world . . . only $2.00. Absolutely unconditional money-back guarantee – and fast service! Mallman Optics and Electronics, Dept; -E1, 836 South 113, West Allis, Wisconsin 53214.

WANTED: Motorola S-1056/57/58 or 59 test set. Also, G.E. test set or adaptor to use Motorola test set on G.E. units. N. Swan RR2, Ludington, Michigan 49431.

PACE SCANNING RECEIVER Model 216 with 94 crystal, $110. Anthony Parker, 65 Belvidere Ave., Holyoke MA 01040.

"I LOVE THE BANJO" my latest Stereo LP 36 tunes Dixie to Classic banjo solo $4.95 PP. Richelieu, The Banjo Man, W9JS, 215 S. Washington, Wheaton, Ill. 60187.

SWAP Ranger II-41-for Gonset G-28 – mint condition. Write W3TEC, 2045 E. Wakeling St., Philadelphia PA 19124.

FREE with the purchase of a new Genave GTX-200 at $259.95: 18 crystals of your choice. Send cashier's check or money order for same-day shipment. For equally good deals on Drake, Standard, Clegg, Regency, Hallicrafters, Tempo, Kenwood, Midland, Ten-Tec, Galaxy, Hy-Gain, Cush-Craft, Mosley, Sony, and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, Inc., R.R. 25, Box 403, Terre Haute, Indiana 47802. (21)-894-2397.

SP600-JX, rack mounting, manual – $250. HT20 AM-CW Transmitter – $50. H13BAC, manual, 34/94, dry batteries – $60. WB2YSR/3, Novas, 422 Cherokee St., Bethlehem, Pa. 18015

DAYTON HAMVENTION expands to three days April 26, 27, 28, 1974 at HARA ARENA and Exhibition Center. Brochures mailed March 15th. Write for information if you have not attended the last two years. P.O. Box 44, Dayton, Ohio 45401.

SALE: Collins 75S-3 AM and CW filters. Matching speaker $350.00, SB-400 $175.00. All crystals best condition. Clarence WBØHDM, 1004 So. Garfield, Denver, CO. 80209.

EXPERIENCED RADIO COUNSELOR. 19 year old Extra Class premed student with experience as YMCA radio instructor desires position at camp during 1974 season. Sanford L. Silverberg WA3RJV, 9 Summer St., Bradford PA 16701.

VERY INTERESTING! Next 5 isues $1. "The Ham Trader", Sycamore, IL 60178. (Ask about our "HAM EQUIPMENT BUYERS GUIDE" covering Receivers, Transmitters, Transceivers, Amplifiers 1945–74. Indispensable!)

SELL: All issues of 73 Magazine. All offers considered. John Hill W4WXJ, 2885 Lyncrest Dr., Nashville, TN. 37214.

SELL: Touchcoder with memory, typewriter keyboard sends perfect code all speeds, neat. $145.00 postpaid, no trades. SASE for information. Stuber W8PJH, Amherst, Ohio 44001.

KLM and MADISON ELECTRONICS present the finest VHF-UHF antennas. 144–148 MHz 7EL to 16EL; 9EL 31.95; 14EL $5.95; 16EL 49.95; 420–450 MHz, 14EL 19.95; 27EL 41.95; Write for literature. Prices fob Houston, include postage with order, excess refunded. Madison Electronics, 1508 McKinney, Houston, Texas 77002. 713/2242668 Nite/weekend 713/4975683.

(More W2NSD/1)

the names and addresses were set on the composer and pasted into place. When ten cards were done a negative film was made of the whole sheet and this was used to make the printing plate.

The cards went through the press for the third time . . . blue for the world on the front . . . black for the QSO information on the back, and black for the call, name and QTH on the front. The result was fantastic – one of the most beautiful cards ever. They take quite a bit of time to do, even when everything is at hand and the art department isn't tied up with 73 for you have to wait one or two days after each run through the press to let the ink dry thoroughly so it won't smudge or offset onto the card next to it.

The last step is to cut the ten cards apart, package them . . . which is another whole big deal getting the little boxes for shipping them . . . you have to buy these by the thousands! At long last they are picked up by UPS or taken to the post office and away they go. You know the postage runs around a dollar on a bundle of 250 cards? Perhaps the $6 price tag is too low for 250 cards.

It is hoped that these low priced attractive cards will help get more ops back into QSLing . . . it's the considerate thing to do.

POPULAR 73 CODE COURSE

It looks like 73 has done it again! The letters of congratulation have been coming in from users of the new 73 Morse code cassette study course. Most readers report being able to learn the code with one playing of the 90 minute cassette, with but two or three errors during the entire time. Over and over the letters tell of trying other code courses and being discouraged.

One aspect that seems very popular is the lack of any need for reading anything. There is no complex book of instructions, no charts, nothing much to read at all, just a simple cassette which can be used anywhere at any time. The cassette gets right down to the business of teaching you the code with the simplest and fastest system yet devised . . . with no long windy explanations. Within five minutes you are starting to copy whole words right in your head.

The individual characters are sent on this cassette at about 12 words per minute, but the spacing between them brings the overall speed down to five words per minute. This is most helpful later on when you are going to 13 per for your mind is already used to the faster characters and all you have to do is get used to translating them a bit quicker. A letter sounds completely different sent at a five word per minute rate and at 13 per, so most amateurs have to relearn the whole code when they speed up, making it much more difficult to do . . . and discouraging many to the point of giving up.

The first mention of the cassette in the October issue of 73 was in a brief paragraph in the editorial and, since almost all readers of 73 are already licensed, not much was expected of the whole business. Again the pulling power of 73 was not properly reckoned with for the orders for the cassettes came rushing in and the scramble was on to get tape cassettes, borrow tape recorders, and work around the clock to turn out the code courses.

Eventually we will have a professional tape duplicator that will knock off these 90-minute tapes in about 11 minutes, recording both tracks simultaneously. We'll no doubt be able to do better at buying blank tape than the local department store.

THE BACK BREAKER

While the 90 minute course does give good practice, the largest part of it is sent at 5 words per minute and in plain text. It was felt that a person really should be able to copy at six words per minute and copy five character groups comfortably before taking the FCC exam. This margin for error would help to take care of the nervousness factor that shoots so many on their first test. When you can copy six words per minute of mixed groups of letters, numbers and punctuation, then you are ready . . . really ready.

Thus was born the BB-6 cassette – the Back Breaker six words per minute study cassette. While you should spend some time copying this code on paper, the fact is that you can get your speed up very well by just copying in your head while you are driving, eating lunch, or pretending to work (with an earphone).

Both the basic code course and the BB-6 sell for $3.95 postpaid. A few readers have written in asking why the low price when most cassettes of this

length sell at about double that price. The answer is simple... we want more hams. If we are unable to get tape at some better prices the price may have to go up a bit, but we'll hold it as long as we can.

13 PER

The hardest text in amateur radio is the General code test where you are required to copy 13 words per minute. There are two reasons why this is such a chore. Firstly there is a hump at around ten words per minute which requires you to change from translating the dits and dahs to an automatic recognition system where you "know" what the character is without thinking about it. Once you have to think you have lost the ball.

The second factor which trips up amateurs on this test is the terror factor. The Novice or Technician five word per minute test is usually administered by a friend or local amateur and the pressure is low. The 13 per is laid on you by a steely eyed FCC examiner and panic is oftensthe rule, shutting down what little brain power you might have brought to help you think. Thus, if the code is not entirely automatic by this time, there is no way that you will be able to get your frozen brain to translate even a simple dit for you.

To help with this problem we have devised a very nasty 14 words per minute cassette with five character groups so you'll have no way of memorizing the material no matter how often you use or re-use the tape. This is brutal at first for the 6 word per minute translator, but persistence will always win out and eventually you will be breezing along with this cassette.

The FCC exam will sound slow to you after you have mastered this cassette. It will sound so slow that you'll be writing us, as so many others have, saying that the confidence you got with the first slow words of the exam made the whole thing easy and even took most of the pressure off the written part.

This cassette also sells for $3.95.

20 PER?

We're working on it.

KOHOUTEK NET

Comet watchers throughout the solar system will be celebrating the visit of Kohoutek and W2IKQ sees no reason why radio amateurs should be trailing behind. Clubs setting up amateur radio exhibits at Kohoutek events are invited to join together on 14300 kHz or 3900 kHz at 0000z.

West Thomas W2IKQ publishes a newsletter called SynergyAccess, modestly subtitled, "A global newsletter of futuristic communications, media and networking." In view of the incredibly poor record man has chalked up in the past trying to foretell the future, the synergists have their hands full.

GETTING DATA

Reading and research is getting more and more difficult as the supply of information expands. More and more firms are in the business of supplying information, some of it of value, some hyped up to make you think it will be of value. It is getting difficult to even find out where to get the information you want.

Some breakthrough should turn up to ease this problem. Perhaps it will be a combination computer terminal video display unit with a sort of video tape attachment. This would permit you to access the "library" computer and start with the index. If you've ever used the Library of Congress you perhaps can appreciate the dimensions of just an index... it fills a huge room... or at least it did the last time I used it back in 1933. That's just the general reference index, other more specialized indexes are in other rooms.

There comes the question of whether this will eliminate the book industry, or perhaps just do away with hardbound books. If you read much at all the storage problem becomes serious. I read about 50 pounds of books and magazines a month... now consider the cost there in paper, printing, postage to bring it here, and the room it takes for storage.

TAPES WANTED

We're still wanting tapes of any ARRL directors who speak at clubs or conventions... as well as FCC officials. We'll copy your cassette and get it right back to you in the next mail.

CB OF VALUE?

An article in the Philly Enquirer sent in by WB2QQQ points out an application for CB that is spreading in use. Truckers are using CB now to warn each other of police cars and radar traps. This application may spread in use rapidly as more truckers and even plain old drivers are clued in to the "service."

The trucker channel may come alive as someone says, "Smokey the Bear is near Exit 15. He's in a plain wrapper, so watch out you don't get green stamps." This obviously translates to police in an unmarked car ready to give out tickets. This is how trucks can zip along at 70 mph and never seem to be caught by the troopers.

Needless to say the truckers refuse to identify themselves when operating and there is little doubt that virtually all of them are unlicensed. So who needs a license to run an unidentified transmitter?

Should the 220 CB band open, this would be even more beneficial for this type of communications, for then the truckers wouldn't even have to contend with Big Red and his five gallon signal on their channel from time to time.

Of course it is possible that the police will eventually mount a counter radio move, with their own illegal CB stations broadcasting bum dope to entrap the truckers. Say, can a branch of government operate illegal transmitters like that?

HAMFEST HINTS

A hamfest has to have several important attractions in order to bring in the brethren. Unfortunately, many hamfest committees give some of these aspects short shrift – and another lead balloon is launched.

The exhibitors are not the beginning and end of a hamfest, but the fact must be faced that without 'em you ain't got a hamfest. So how do you get exhibitors to come? If you convince them that you will have several thousand live amateurs in attendance they will come. The greater number of amateurs you draw, the further they will come from.

You have to start early with manufacturers and distributors for their available dates fill up fast. Well-established hamfests start a year ahead with their PR and booth solicitations. The charge for a booth is ticklish for if you set it high it will keep the smaller firms out – and if you set it low you may not have enough money for everything. I would suggest a fee on the order of perhaps $35 per one thousand of licensed amateurs honestly expected to attend for each ten foot by eight foot deep booth. Your booths will include tables and chairs, with tablecloths, plus back and side drapes.

Be sure that you have a shipping address for booth material and free storage too. Be prepared to help deliver this stuff to the booths, and it is a good plus to have a couple (or more) Novices on hand to help put some of the bigger booths together. Remember to have some youngsters (gals are great for this) as gophers – to go fer cube taps – tape – wire cutters – string – all that stuff that should have been remembered, but wasn't. They can help get up antennas for portable repeaters, demonstration rigs, etc.

Remember too to help exhibitors with their hotel reservations – can you get them a special hamfest

rate? – maps showing how to find the hotel and hamfest area – anything like that which might be helpful. Be sure to have nice signs made up early so exhibitors will know where to set up. Don't forget power for those that need it.

Your gophers can also be on tap to spell exhibitors so they will have a chance to get around and visit some of the other exhibitors – get out to lunch – or go potty. Be sure that some willing workers are not taken advantage of – more than one exhibitor has been known to set up a booth and then walk away from it for hours – which is lousy for the hamfest and murder on a gopher. You might set a time limit for such sitting services.

Enough on the exhibitors – you must have attendees too, or your exhibitors will go away and and never come back. Is there a big mystery on how to get thousands of amateurs to come to a hamfest?

In the olden days you needed lots of prizes. They will help, but they are not the drawing card they once were. Large numbers of smaller prizes seem to be better than a few expensive ones, by the way. Someone who has paid $4 entry fee for your hamfest will be happy if he walks away with a $7 subscription – a $9 Callbook – a soldering iron – five pounds of solder – a spare speaker – a small IC kit – stuff like that. They've got their money back! You can give 200–300 hams their money back for the price of one rig...and you'll have 200–300 more hams talking you up the next year.

Today, with the increased interest in specialized aspects of the hobby, your program is one of your most valuable assets – and can be the apple that spoils the barrel for you if you neglect it. Remember that you have avid FMers – repeater nuts (they put up the repeaters the FMers use) – DXers – 160m fans – X-CARS nets – certificate hunters – RACES – Mars – slow scanners – RTTYers – VHFers – satelliters – mobilers – and others. Get the best speakers you can for your forums and make sure that PR gets to each group involved. Your RTTY speaker or panel should be hyped in the RTTY magazines – and in the RTTY columns of the regular ham magazines. Ditto slow scan – DX – etc.

A celebrity won't hurt any. Barry Goldwater will bring 'em in by the hundreds. You have to plan a year ahead to get the FCC to pay for one of thei; men to show – and that is the only way they will play ball – but you might end up with the Chief of the Amateur Division – whoever that is at the time. You might even get an FCC Commissioner.

Unfortunately there are not very many proven speakers once you've been turned down by Barry.

Try to deploy your best speakers at your best times. Few speakers make much of a dent when the audience is hot and sweating – or sitting back after a banquet quietly urping – or at the end of a hectic hamfest day. These are better times for lesser lights talking about their specialites.

To have a good turnout for your hamfest you will have to get every one of the local hams you can to be there – plus as many as you can cram in from afar. FMers will fly across the country for a good FM program – and so will the other really hot branches of the hobby. DXers will come in from foreign countries – so will slow scanners if you have the program and get the word around.

Those locals – how do you get them off dead (right word) center? You do not leave it to chance. You put up posters in radio stores – you organize members of every club in the area to canvass all bands for a couple of months before the hamfest to personally invite everyone they hear to come – particularly on the shorter range bands. You organize a phone call canvass of all local hams. You might even arrange to try for the ARRL membership list for your area and send them brochures.

You'll want ads in the ham magazines. For the most part you can bargain with them for booth vs ad space – but you may want to use one or two (one is enough) to reach the really active hams with continuing ads. This is not all that expensive if you use 73 (plug).

When setting up your hamfest area keep security in mind. Exhibitors should be able to leave their booths wide open overnight if your event runs two days – or if they set up the night before. If you have a flea market be sure that it is separate from the exhibit area so fellows won't be carrying rigs around to confuse your guards. You'll have to accept hand units – they'll be everywhere. Make sure that those opaque bags are not permitted as they help encourage youngsters to flip stuff into the bag when no one is looking. Pilferage has risen tremendously at a few of the recent hamfests as a result of these opaque bags. You'll also want to be sure that everyone in the hamfest area has a ticket.

When planning your finances you should aim at bringing in a reasonable profit for this money will be very handy for getting the event going next year. With some money in the bank you can invest in prizes, ads, brochures, direct mail, etc.

If you get plenty of exhibitors and plenty of attendance you'll have a going hamfest. It does take work and coordination, but it isn't difficult, just exhausting.

DESTROYING OUR CHILDREN?

Saturday morning is a great time to get on the air and work some DX – rag chew – and generally ham it up. But what are your children doing while you're on the air having a ball? Chances are, unless you have TVI, that they're in the other room being stupified by Saturday morning television. In between contacts, just mosey in and see what kind of stuff is being fed into their minds by the bushel.

You'll probably find them staring intently at Dr. Doolittle – now what could be less harmful than that? The good doctor and his animals face various bad guys and win out. Take a look at the bad guys that are threatening him – Italians, Turks, Spaniards, and ethnic types – every one of them. And all with odd accents to boot. The heros, needless to say, are clean cut WASPs with excellent speech.

It is tough enough for us older generations to cope with the concept of equality after a lifetime of propaganda – we hardly need to have these biases passed on to our children. The cartoons are written and executed by older people who are so used to these biases that it probably never occurs to them that they are biases.

Your daughters are being fed large doses of old fashioned female stereotypes via these same programs. Have you ever wondered why the sound of a female voice is so rare on the air? Is this due to some genetic difference between women and men or is it merely a matter of training? (I used the word "merely" just to see if I could get it by you without your noticing – there is nothing mere about the constant propaganda girls get to convince them to stick to the motherhood–doll–housecleaning–cooking role. This means that girls can't understand anything technical or complicated and have to turn to us strong and smarter men for help when the light bulb needs changing.

But we do have a few female hams, so perhaps it is possible for a woman now and then to escape the clutches of this omnipresent conditioning. In fact the Callbook indicates that some 11,000 YL's are licensed – and that is about 4% of our total ham population. It appears that most of these are the inactive wives of hams and for some odd reason they went to the trouble to get their tickets – or were given them via the Tech route. Most

of the licensed YL's I know fit in this category. You hear darned few of them on the air – certainly a lot less than 1%.

GLOOM OF NIGHT DEPARTMENT

One part of the publishing biz is getting a daily bundle of complaints from subscribers about late copies. Apparently only a small percentage of my fellow Americans are even remotely aware of how bad the mail service – and there is nice pair of words – about as much of a contradiction of terms as "army intelligence" – has gotten. The twice daily delivery of two cent letters is past.

Naturally my mind turns away from frustrations with the FCC and ARRL to thoughts of how to get the damned mail system back into working order. Simpler problems like this are perhaps a way for me to avoid larger problems.

Two tacks suggest themselves. One is a standardization of mail system which would permit almost total automatic sorting and handling of the stuff. The other approach has to do with the utter absurdity at this time in history of having to send a particular piece of paper physically from one place to another, using the paper simply as a media of carriage. That aspect of the mail hasn't changed in centuries – eons.

Well, it hasn't changed much. I suspect that one part of the problem is that the startings of change got intrenched and never developed much. The Teletype machine – which grew to popularity in the early 20's, has changed very little since then. Pity, for the basics for a big change were inherent in the concept.

Perhaps we'd do well to put aside all of the present communications systems and take a look first at what we want to do – then at how it could be done.

Since about 90% of the mail today is business correspondence, let's take a look at the parameters involved in this type of communications. A relatively small percentage of this starts out as dictated letters which are transcribed by a secretary or steno and then mailed. Most of it tends to be invoices, acknowledgements, statements and other forms. Routine correspondence like this would seem to be ideally suited to some new system – a fast system – a bulk handling system.

Any new system would have to cost less overall than the present mail system. This is hardly a restrictive parameter in view of the rising cost of sending letters – soon going to 10¢ each, it is rumored. Cost considerations do eliminate some complicated computer terminal solutions, satellite access, things like that. But perhaps there are machines in general use already – and services – which could be better utilized.

For instance it would seem reasonable to think in terms of using the telephone lines as part of the "mail" system. They reach into every home and business in the country – and are getting into same in many other countries. These lines are used only a very small percentage of the time – which means that we could use them for a lot more than they are presently being used in the name of efficiency if for no other reason. Actually, using common techniques, it would not even be necessary to interrupt the telephone use of the lines to use them for many more applications.

One other piece of major electronic equipment is already in every home – the television set. And the bulk manufacture of this item has brought the price down to remarkably low levels. It might be worth while to think in terms of some sort of "mail" system which used telephone lines and a television set as a terminal monitor.

Starting with that combination I am certain that any number of engineers will be able to devise relatively inexpensive terminal units which will do the rest. There are new ideas on what types of encoding are best for sending the most written words per unit of time per bandwidth. Probably digitalized. A small keyboard, perhaps like some of the touchtone pads we are using on hand units, might do for writing the messages. Tape cassettes would do for temporary or permanent memory of messages. The message would then be displayed on your TV set as you type it and, when all done, could be fed into the phone wires.

Local phone offices would automatically record the "mail" and sort it by zip code (or whatever) to area centers. It would probably be best to hold messages until several were ready for a particular regional destination. You can take it from there.

Scanners are now being built which optically scan typewritten material and convert it to any code you like for transmission. These would be more costly and probably of value to larger businesses.

Computer bookkeeping and inventory would be greatly simplified by such a fast and relatively automatic communications system. Company A could originate an order for material and send it. Within minutes the acknowledgement would be received. The shipping memo would tell them when the material was sent and how, with details on insurance, routing. The invoice would tie all this together. The packing slip from the received goods would finish the matter and trigger the notice of payment (used to be a check) – and this might be confirmed by an automatic statement of account from the shipper indicating that all is complete.

Using modern data transmission techniques the cost per transaction should be miniscule – perhaps 1/10th of the cost of using the post office system – and think of the time savings. This makes it possible to automate the entire system and have only problems alert live people. This further cuts costs – enormously. And by eliminating vast gobs of routine, it should make life a little better for all involved.

Amateur Opportunity

As far as I know, little work is being done on inventing a system such as proposed above. This would appear to be an area that might be open to the amateur. By amateur, I don't necessarily mean a radio amateur – just someone who is not professionally working in the industry.

Amateurs have a distinct advantage over professionals, as you are probably aware. Firstly they usually have less that they "know" to be so. This gives them a much greater flexibility. Most of the truly innovative inventions have been made by amateurs because they have this edge.

One other major advantage is that professionals are working for a profit-making concern. This means that unless a proposed invention has a 100% chance of being made and used, that funds will not be available for experimenting and development. Amateurs can afford to spend years working on ideas that have only a small chance of success.

Automatic Mail Handling

The post office has experimented with gadgets to read addresses and sort mail automatically. I understand that these were less than perfect and that not much more has been done along this line. I suspect that the main drawback was the post office attempt to adapt their machines to the vagaries of the public rather than trying to get the public to adapt to the postal machines.

By setting a slightly lower postal rate, the use of standardized envelopes and addressing could be encouraged. They could use any system they wanted – from punched tapes to magnetic print to typing. Whatever system is the most foolproof at present would be best. I suspect that a magnetic system such as is being used for bank checks might be easily adapted. The machines for addressing would quickly be available.

Magazines could be handled quickly and at a fraction of today's cost if they were standardized and automatic

sorting were used. Magazines are going to be with us for a long time to come, so we might as well start working on a less expensive and faster way to get them delivered.

If the post office started putting in sorting equipment and offered a penny saving per magazine every publisher would quickly change to the official magazine size and put in the addressing equipment.

Going back, for a moment, to that home television-telephone terminal – once you have that set up why not use it for ordering things you want to buy – food from the local market – stuff from Sear's – or even magazine subscriptions? There is much to be done along this line.

A VISITING DELEGATION

Your congressman will appreciate getting a visit from you. The most effective way to handle this is to arrange for three or four representatives to come to Washington from your group – no more than four. Call ahead and arrange for a meeting time – and be there on time without fail. Then, in not more than ten minutes, get your message across – and do it without emotional hassle. Make it a consistent message and leave the emotional aspects out. Make it articulate. Your congressman is intelligent and he will probably get bored if you start wandering from one point to another. End up your message with what action by your congressman will be of help to you. Let him know what he can do.

You might take about a minute or two to fill him in on what amateur radio has done and is doing – how every major communications system in use today was invented and pioneered by amateurs – and that amateurs are still in the vanguard of this, even though techniques are enormously complicated today. Amateurs invented present-day single sideband – narrow band FM – etc.

Then bring up your main problem – probably the repeater docket. Give some of the major difficulties and their impact on his constituents – and then what you would like him to do about it.

The fact is that you can have a profound effect on what is happening. You don't have to just sit there and frustrate because ARRL has no Washington lobby. You can be part of the amateur voice in Washington. Your congressman will help you, once he knows what you want him to do.

The impact on the FCC of a call or note from a congressman or senator is profound. The Commission knows where the money comes from – and they know that if they get complaints from congress that they had better do something about it. This might mean replacing Walker with someone who will be less restrictive in both regulations and interpretations of the regulations. This might mean backing down on repeater regulations and interpretations of the regulations. This might mean backing down on repeater complications and restrictions. This might even mean blocking the 224 MHz CB proposal.

Right now there is one voice being heard in Washington in support of amateur radio – and this is *yours*. Are you speaking loud enough to be heard?

Is FCC Rulemaking Procedure Outdated?

In the case of amateur radio, the ever accelerating technology would seem to have made it impossible for the rules to keep up with the current state of the art.

In one case after another we find that it takes not months, but many years for new rules to be formed – and then, after all of that work, we almost invariably have been finding that the rules are so far out of date by the time they are enacted that there is little need for them – or that they miss their mark by such a wide margin that they are more harmful than helpful – and the prospect of starting over again on a many year project to get them changed is discouraging.

Two meter FM repeaters sprang from a little known development to the largest single interest in amateur radio in a space of about three years. Some of the pioneers proposed rules to help repeaters grow way back in the beginning. By the time the rules came out the growth had already happened and the proposed rules were no longer appropriate.

It would seem that some basic change should be made in the rulemaking procedure – one that would make it possible for the rules to keep up better with the state of the amateur art – and one that would permit changes to be made as the need becomes apparent.

The amateur service is well known for its ability to self-monitor, perhaps it is time to consider some method whereby the service could also be self-regulating.

It has been proposed – and, indeed the FCC has indicated that it is considering, some sort of system whereby amateur clubs could take over the function of examining applicants for amateur licenses. This responsibility could help to give many clubs more of a purpose for existing and a focal point for their activities. It seems possible that such a function might encourage more clubs to set up training courses and programs to get more teenagers into the hobby.

If, in addition to the training and examining of new amateurs, clubs also could participate directly in the formation of new regulations, this might do even more to create a personal interest in the amateur service on the part of the average amateur.

Any number of legislative systems could be set up – a board of directors along the line of the ARRL – who could meet regularly (perhaps yearly) to do the bidding of their constituents – or perhaps a meeting similar to that held by the ITU where representatives would be present from each concerned radio club – with their expenses paid for by the clubs – where rule changes would be first put into committee and then reported to the body at large for passing or vetoing.

The committee system helps to preserve the interests of minorities – and since amateur radio is made up of a bunch of minorities, this might be a good system.

These are just some ideas – perhaps you have a suggestion that is worth consideration as to how to change the rulemaking procedure to help amateur radio grow more smoothly?

INFO?

Being up in the backwoods of New Ham Shire it is possible that we may have missed some new developments and readers may be able to send along some data that will help. Are there any relatively new addressing systems for office use? We have an Elliott system – and it does leave a lot to be desired. We've tried the Scriptomatic and have had to develop a high resistance to incredible frustration in its use.

What Am I Eating?

Reading the fine print: Corn syrup solids, vegetable fat, sodium cascinate, mono and di-glycerides, dipotassium phosphate, sodium silicoaluminate, artificial flavor, artificial colors. Or I have a choice of hydrogenated palm kernel oil, sodium cascinate, sugar, dipotassium phosphate, propylene glycol monostearate, polysorbate 60, stearoyl-lactylate, salt, artificial flavor and color. Where am I?

New QRP Idea

A letter from WA7UKP proposes an interesting idea. He observes that the Extra CW bands are pathetically empty – ditto the phone bands. . .so how about making use of these bands by permitting QRP operation in them by lower class operators – say five watts or even less? Maybe even one watt?

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John J. Schultz W2EEY
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Brooklyn NY 11227

WIDE RANGE IC AUDIO OSCILLATOR

A 20 to 20,000 Hz oscillator using a single 741 op amp

Many radio amateurs still do not own a good, wide range audio oscillator so they can make realistic checks on audio circuits. That problem can be readily solved by constructing the unit described in this article. It may seem extradorinary that so much performance can be obtained from an inexpensive and simple to build unit but here are some of the main features of the unit:

1. A minimum range of 20 to 20,000 Hz in three switch selected ranges.
2. Harmonic distortion as low as 0.15%!
3. Single, inexpensive IC construction (a 741 op. amplifier).
4. Battery operation for complete portability.
5. Long battery life(only 6 mA drain from one or two 9V batteries).
6. Square wave output adapter (another simple IC).
7. Expanded scale readout in the speech range of interest to most experimenters (200 to 500 Hz and 2000 to 5000 Hz).

All of the features above, except for the square wave output, are provided by the circuit of Fig. 1.

The circuit is that of a Wein bridge oscillator using a 741 operational amplifier. Any of the various 741 packaged amplifiers may be used. The dual–in–line versions sell for about 50 cents and metal can version which the author used costs about $2.50. The op amp is internally frequency compensated and a minimum of external components are necessary to form the ocsillator circuit.

The components that are necessary for the Wein bridge circuit need not be expensive but they should be chosen with a bit of care. The dual potentiometer used for frequency control can be a type designed for stereo audio systems where the two pots track within 3 dB or less. The potentiometers must however, have a linear resistance taper if the frequency scale template described later is to be used. An Ohmite CCU2531 is

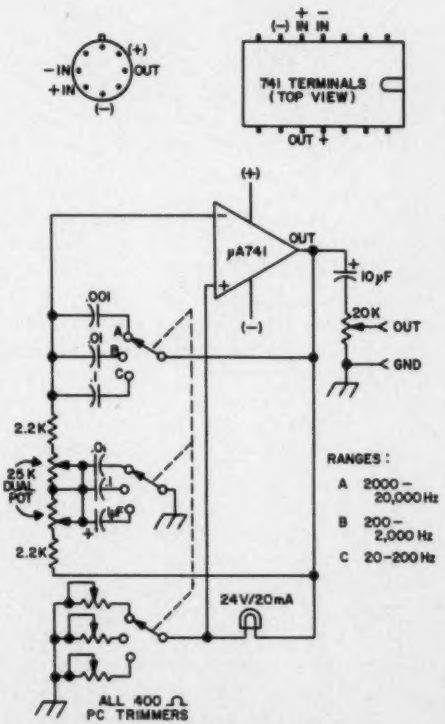

Fig. 1. Generator circuit. See Fig. 2 for power connections.

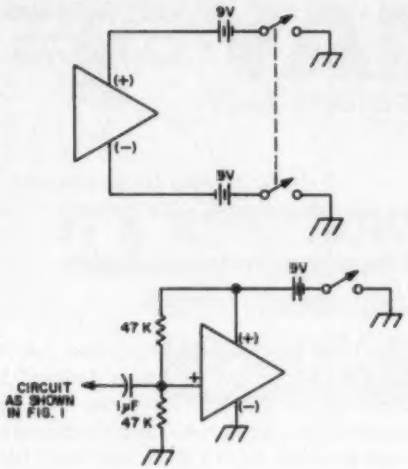

Fig. 2. Options for dual or single 9 volt battery supplies.

one example of such a type but many other types are usable as found in many ads for discounted price components. The capacitors used should be either of the Mylar (10% tolerance) or paper types. Disc ceramic types, because of their poor temperature stability, are not acceptable and are particularly to be avoided. It is not necessary but it would be advantageous to be able to measure the capacitors used and choose values as close as possible to those shown. The main advantage in doing this is that a minimum of readout shift will occur when one switches between ranges with the frequency pointer set at, for example, 200, 2000, or 20,000 Hz. The minature lamp used between the output of the 741 and one input stabilizes the output level. A 24V 20mA lamp seems to work particularly well but other types with voltage and current ratings down to 10V and/or 15 mA can also be used.

The above comments about the selection of parts may seem a bit tedious but all the parts necessary for the "heart" of the oscillator can be purchased for $5 or less! The rest of the cost for the oscillator is only dependent upon how elaborate a housing one wants to use and how fancy one wants to make the frequency readout scale.

There are two options available to power the oscillator. Either a single 9V battery can be used or two 9V batteries. Fig. 2 shows how the connections are made to the 741 for either option. When using a single 9V battery, it is necessary that a resistor and capacitor network be added to the 741 to bias one input to half the battery voltage. The advantage of the single 9V battery, besides battery cost, is that a SPST switch (which may be part of the range switch) is only necessary as an on/off switch. The disadvantage of the scheme is reduced maximum output (about 2V) and slightly increased distortion (about 1/2%). The author used two batteries although a DPST switch is then required as an on/off switch. With two batteries you cannot use a SPST switch in the ground return lead as an on/off switch. The still flowing unbalanced current of a few mA. will eventually drain the batteries.

There is nothing critical about construction. I constructed all of the circuitry on a small square of perforated board stock which was wired together with the range switch. This method compacted all the wiring in one location and the only other wiring was from this board to the dual 25 K pots, the batteries and the output level pontentiometer. Leads on the board should be kept short and can be centrally placed around the IC. A socket for the IC is suggested so one can apply enough heat to be sure joints are properly soldered without causing damage to the IC.

The simplest form of readout for the generator is a printed scale. Fig. 3 shows the template for the frequency readout scale which can be made in any size as long as the relative dimensions are maintained.

Using the parts suggested, the scale shown should provide accurate readout that is sufficient for most experimental purposes. A more accurate scale can be developed, of course, if one has access to a counter. Any large size knob with a 270° scale on its flange reading in relative units (0–100, for instance), can also be used if one doesn't mind referring to a logging scale to find the frequency being generated.

The adjustment of the three 400Ω trimmer potentiometers, one for each frequency range, can be done in several ways to

obtain the purest sine-wave output waveform. The simplest method is to listen to the output on an audio amplifier and adjust the potentiometers so the generator just starts to oscillate. There will be found to exist a point on the potentiometer where the oscillator just alternates between sustaining oscillation and having the oscillation slowly decay. Adjusting the oscillator in this manner carefully, one can achieve a harmonic distortion of less than 1–2%. Unless one is engaging in hi-fi work, this distoriton is probably acceptable for most work on communications circuits. One should make the adjustment at mid-frequency on each range and be sure oscillation continues at each end of the range. If one has an oscilloscope, a further refinement is possible by being able to see the point at which the oscillator just goes into the state of sustained oscillation. If one is really fortunate to have access to a distoriton bridge, the output can be adjusted to bring the harmonic distortion to 0.1–0.2%. The author tried the "listening only" audio distortion bridge. The distortion achieved was always less than 1%!

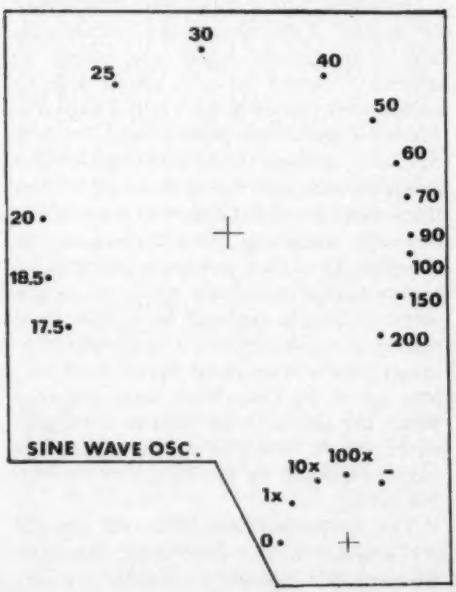

Fig. 3. Template for frequency scale achieved if components specified are used.

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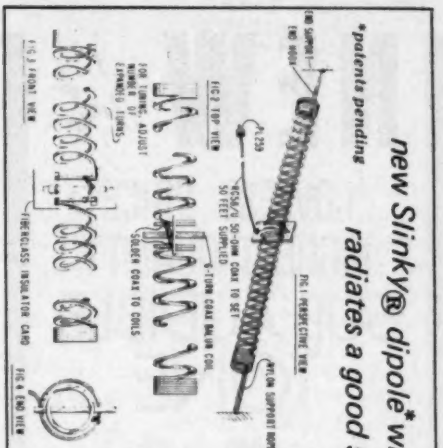

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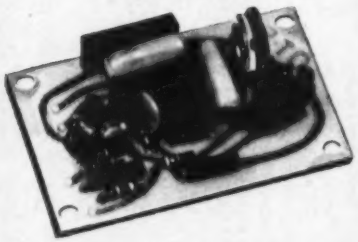

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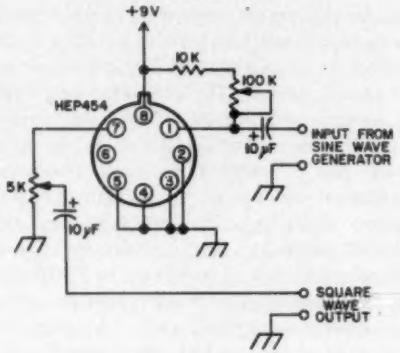

Fig. 4. Square wave converter accessory.

Battery life is quite long since in the two–battery powered version, the drain from each battery is only 6mA. Ordinary 9V transistor batteries are adequate and extra capacitance across the batteries to reduce their internal resistance was not found necessary. The output of the generator can be safely utilized in any position of the output level control. Because of the IC used, it is internally short–circuit protected.

For some work a square wave output may be desired. Although one can crudely connect a diode pair across the output to achieve a square wave, a proper sine to square wave converter, such as that shown in Fig. 4, is much more satisfactory. The HEP 581 is a 4 input NOR gate with output amplifier, although the latter is not used in the circuit. The input sine wave is applied to one gate while the other three gates are gounded. The 100 K pot can be adjusted for a symmetrical waveform using an oscilloscope or simply replaced by a 47K fixed resistor if symmetry is not important. The circuit produces excellent square wave outputs up to 30 kHz. When using the converter, the output from the sine wave generator should be set at maximum and the output regulated by the 5K pot in the Hep 581 circuit.

The instrument described will provide any amateur with a dependable means to measure the frequency response of any audio circuit, trouble–shoot modulators and other audio equipment..

...W2EEY

Richard W. Fergus W9DTW
2N570 Argyle Street
Lombard IL 60148

ANOTHER ID GENERATOR CIRCUIT

OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON-OFF-ON-OFF-ON
OFF-ON-OFF-ON & ETC.

Many ID generator circuits have been published during the past few years. Each circuit usually had some advantage but few, if any, seemed to be both simple and easy to use. After some thought on the subject, I discovered a different approach which simplified the circuitry and made the programming very simple. Let me repeat the reasoning I went through to reach the final circuitry.

First, the signal we are trying to generate is nothing more than a series of OFF and ON conditions which have two different time durations. The ON condition can be of one time duration (dot) or of three time durations (dash). Likewise the OFF condition can be of one duration (space) or three durations (blank between characters). At first the different time duration requirements suggest counting a single frequency (pulse generator). After considering this you soon realize that many decoding steps will be necessary, e.g., a dash-blank would require six steps. This seemed to be a waste of circuitry so another approach was needed.

If we consider this OFF-ON signal coming from an oscillator which can be controlled to produce independent ON and OFF time durations, the decoding requirements will be reduced drastically. One counter step can be used for an OFF-ON code pair. Although this oscillator may be a little more complicated, the decoding reduction could more than offset for this additional circuitry. As will be shown, the additional circuitry to accomplish this generator function is minimal.

The next problem is to derive the signals necessary to control this oscillator. Obviously we need to count the OFF-ON code pairs and provide some means of feedback to the oscillator. Again, the first thought tends to follow the conventional means of decoding each step of the counter which gives us a separate signal for each step. The only trouble is that we need more than one type of signal for each step. Since both the OFF and ON signals are part of one step, a separate control of each is necessary. Actually, each step can have four possible combinations: space-dot, space-dash, blank-dot and blank-dash. There is an easy answer to this apparently complicated problem.

A multiplexer can provide the function we need. A multiplexer is the opposite of a decoder. While the decoder provides a sepa-

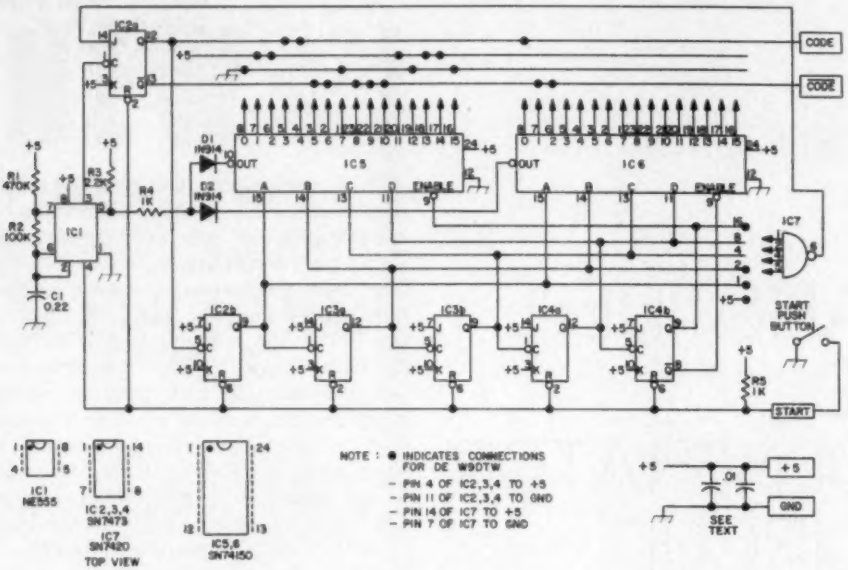

Fig. 1. Schematic of the IC identifier. Connections for the program "DE W9DTW" are shown at the top.

rate output for each counter step, the multiplexer selects one of a multiple inputs and switches it to a single output. Now all that is necessary is to tie each multiplexer input to a signal which will control the oscillator for the designated step.

We still have four possible step combinations to generate but before we complete this part of the design, we should return to the oscillator. The oscillator consists of two parts: a pulse generator and flip-flop. The necessary feature is that the pulse generator pulse period can be changed independently of the flip-flop state. If the pulse period is shortened while the flip-flop is in the OFF condition, a space is generated instead of the longer blank. Similarly, if the pulse period is shortened while the flip-flop is in the ON condition, a dot is generated instead of a longer dash. So, if we provide a signal to the pulse generator during the ON condition only, the ON condition is modified, or if we provide a signal during the OFF condition, only the OFF timing is modified.

Now we should be getting a clue as to what signal is needed at the multiplexer input for each step. If we assume that a HIGH logic signal will decrease the pulse duration or speed up the flip-flop action, the signal into the multiplexer should be HIGH when we want a shorter duration (either ON or OFF). If a continuous LOW is applied, the oscillator output will be a blank-dash series. If we want a long OFF output but a short ON output (blank-dot) for a particular step, we can connect the appropriate multiplexer input to the oscillator output. Now when the output is OFF, the pulse generator has a long duration but as soon as the oscillator switches to ON, the pulse generator will speed up. If we want the opposite cycle (space-dash), the inverted oscillator output is connected to the multiplexer input. If a continuous HIGH signal is connected to a multiplexer input, both parts of the step will be shortened and a space-dot will be generated. Therefore, each multiplexer input must be connected to one of four signals: LOW (ground), HIGH (power supply), output (CODE), or the inverted output (CODE). Since these connections are multiplexer inputs, no diodes are required . . . only wire jumpers.

The schematic illustrates the circuitry that performs the described functions. The oscillator is composed of IC1 and IC2a. A

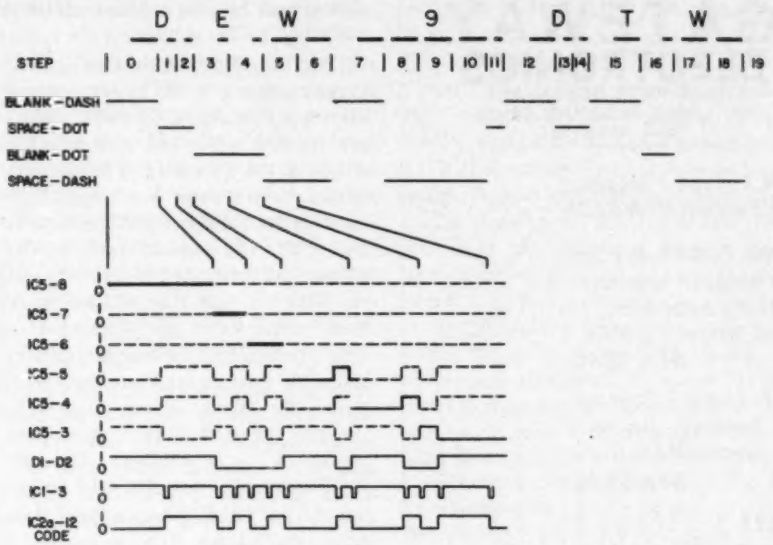

Fig. 2. An example of the waveforms at each IC during the beginning of the indicated program.

free-running oscillator (NE555 timer-IC1) drives a flip-flop (IC2a) to generate the required OFF-ON output pattern. The NE555 (a very useful IC) consists of two voltage comparators, a discharge transistor, and output flip-flop. When connected as a free-running pulse generator, the capacitor (C1) is alternately charged through R1-R2 and discharged through R2 and the IC discharge transistor. When the capacitor voltage exceeds the high comparator (pin 6) the output flip-flop is switched off and, conversely, when the capacitor is discharged below the comparator (pin 2), the flip-flop is switched on. The discharge transistor (pin 7) is turned on when the flip-flop is off or when the output (pin 3) is LOW. The reference voltages for the two comparators are available through pin 5 so that the frequency or pulse period can be changed with external (to the IC) circuitry. Without external circuitry on pin 5, the high switching voltage is about 2/3 of the power supply (pin 8) and the low switching voltage is about 1/3 of the power supply.

The pulse generator output (pin 3) is used to drive the oscillator flip-flop (IC2a). Each HIGH to LOW transition of the pulse generator causes the flip-flop to change state. The time of each state (either ON or OFF) is

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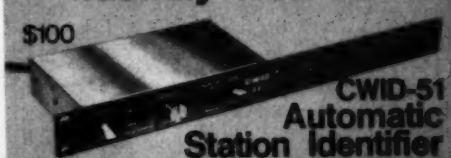

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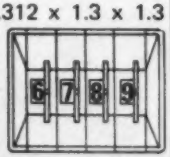

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determined by the pulse generator which is contolled by the voltage on pin 5.

The flip-flops IC2b through IC4b are connected as a 5 bit binary counter which gives a maximum of 32 steps. Only 31 steps are useable since one step is reserved for stopping the generator. The outputs of the first four flip-flops are connected to the appropriate inputs of both multiplexers (IC5 and IC6). The enable inputs of the multiplexers are connected to opposite outputs of the fifth flip-flop. Even though the inputs of both multiplexers are connected together, only one multiplexer can function at a time since the enables are connected to opposite signals. In effect, as the counter proceeds through the first sixteen steps, one multiplexer (IC5) is enabled. The first four flip-flops repeat for the next sixteen steps but the last flip-flop has changed state so the other multiplexer (IC6) is enabled for the last sixteen steps. The diodes (D1 and D2) in effect "or" the inverted multiplexer outputs. Therefore the diode's anode signal is the scanned result (and inverted) of the various multiplexer inputs as the counter proceeds through up to 32 steps.

The generator must be stopped and started and that is the function of the switch and the nand gate (IC7). The nand gate decodes the stop position which is the step following the last dot or dash. As the counter proceeds through the code generation, the nand gate output is HIGH (inputs not satisfied). This output is connected to the J input of the code generator flip-flop. As long as the J input is HIGH, the flip-flop will continue to toggle with the pulse generator signal. When the stop step is decoded (nand gate output goes LOW), the flip-flop will stop in the OFF state. The flip-flop will remain in this state until a start signal is applied.

To start the generator, the start switch is operated. When the switch is closed, all counter flip-flops, the oscillator flip-flop, and the pulse generator are held in a reset state. When the switch is released, the pulse generator starts and, one period later (blank), the code generator switches to the first ON code of the sequence. Thus the start switch does two things; resets the counter

and holds the code generator in the OFF condition.

Programming the generator for various calls is very easy. The code sequence is divided into OFF-ON pairs with the OFF preceding the ON. Each pair is considered one counter step and the pairs are numbered starting with zero. Preceding through the steps, the appropriate multiplexer input is connected as follows: for blank-dash connect to LOW (ground), space-dot connect to HIGH (power supply), blank-dot connect to CODE, and spash-dash connect to the inverted output or $\overline{\text{CODE}}$ (overline indicates inversion).

The nand gate (IC7) inputs are connected to decode the stop step. In this circuit, the counter is never allowed to count higher than the stop step, therefore the gate requirement for the stop decoding is reduced. It is only necessary to ((and)) the counter stages that have decimal equivalents which add up to the value of the stop step. What happens to the gate output for the following counter steps is not important. This simplifies the nand gate requirements to note more than 4 inputs except for step 31. As an example, step 19 is required for DE W9DTW. The decimal equivalents of the binary stages (1, 2, 4, 8, 16) which add up to 19 are 1, 2, and 16. This requires a three input gate (schematic shows a 4 input with the unused input connected to HIGH).

As you may have deduced by now, the total steps is equal to the sum of the dots and dashes plus one for stop. Some calls may not require more than sixteen steps and the second multiplexer and one counter flip-flop can be deleted (enable of remaining multiplexer connected to ground). My call without the DE only requires 15 steps and could be generated with one multiplexer. To illustrate the programming, Fig. 1 describes the connection to program DE W9DTW which requires 19 dots and dashes or a total of 20 counter steps. The large dots on the schematic indicate connections for this programming.

Figure 2 shows various waveforms for the first few steps of the DE W9DTW ID cycle. The first five waveforms describe the inputs to the multiplexer with the solid portion indicating the time when that input will be switched to the multiplexer output. The next waveform is the multiplexer output (inverted form of the selected input waveforms). The oscillator waveform illustrates the control by the multiplexer output. Notice that when the multiplexer output is LOW the oscillator period is short (opposite from previous description because of multiplexer inversion). Each HIGH to LOW transition of the oscillator toggles the code generator flip-flop as shown in the last waveform thus generating the code pattern.

The oscillator frequency controls the code speed and the components values shown will give about 20 words per minute. For other speeds, the time constant (R1-C1) can be changed. Generator speed is inversely proportional to this time constant, e.g. time constant reduced by ½ will double generator speed. Weighting (ratio of dot to dash) can be adjusted with R4 but should not be necessary.

The power requirement for the circuit is 5V at about 175 mA. The two outputs (CODE and $\overline{\text{CODE}}$) are standard TTL levels (3.5V for HIGH and 0V for LOW). Either output should be able to drive a load of 1000Ω or more (some variation in driving capability depending on multiplexer input connections with programming for different calls). The start circuit can be momentarily or indefinitely closed but, in either case, the code sequence will start when the circuit is opened.

There is one construction practice that cannot be over-emphasized for TTL logic systems. Ceramic capacitors (.01) should be scattered around the circuit layout between the power supply and ground. Usually a capacitor for every three or four IC's is sufficient. These capacitors reduce switching current transients which can cause erratic operation. Flip-flops are more sensitive to these currents since false switching can occur. These pulses are very short and difficult to detect so it is better to add the bypasses in the beginning. Otherwise any IC fabrication method can be used for this circuit. I prefer the perforated Vectorboard (pattern P) and Molex pins. This isn't as neat as an etched circuit board but it is faster to fabricate and easier to modify.

. . . .W9DTW

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CONSTRUCTING OSCILLATORS FOR 432 AND 1296 MHz

The construction of microwave oscillators for the amateur bands beginning at 432 MHz can be rocky, unless certain principles are observed, as you will see.

The Halfwave Circuit for Oscillators

This type of oscillator circuit is very useful when you start to run short of line length as you attempt to go up in frequency with a quarter wave line. Generally speaking, at 432 MHz you *can* use a quarter wave line which is common practice for that frequency.

At 1296 MHz the length of L1 begins to get very short, and you will do better with the half wave line discussed later on.

432 MHz Oscillator

Please refer to Fig. 1 for the following. A transistor oscillator requires the base to be out of phase with the collector. This assures the use of C2, a brass plate capacitor without leads which is integrated with the ground plane as far as rf is concerned. This works best when positioned directly under the collector connection of Q1, but it still works well a little to one side.

The lead from the base capacitor C2 to the dc bias network should have only dc on it and so can be of any length. But do not run it on top of the ground near L1 or it will pick up rf again. It is best to run it out and down through a hole in the baseboard. The surface of C2 nearest the baseboard should be filed, smoothed, and polished flat. A thin fiberglass sheet preferably no more than 3 mils thick, should be used for a dielectric. This must be held tight, flat, and firmly between the brass plate of C2 and the baseboard. In this manner you will have the base 180 degrees out of phase with the collector, and the oscillator will work.

Of course, while the base is out of phase with the collector, you do not want rf on it. You want to "hold it still" for rf and let the emitter receive the "input rf" by means of the internal feedback. This energy is amplified and some of it is returned to the emitter, thus constituting an oscillator.

How to Treat the Emitter

In this type of oscillator, the emitter should "float free," receive rf from the collector by internal feedback as outlined above, and thus drive the device into oscillation. It will do this. In fact, it will do it so well that you can very easily get into much trouble with persistent oscillation on harmonic frequencies as described in the following paragraphs, if precautions are not taken.

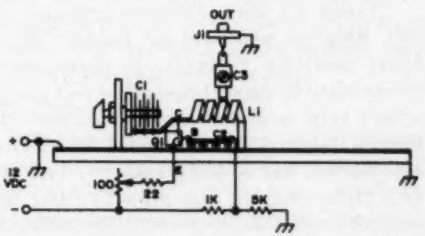

Fig. 1. Good final oscillator for 432 MHz. L1-4T no. 20, 6 mm OD; C1 – Johnson type M, 5 plate; C2 – see text; C3 – 2-8 pF mica trimmer.

Trouble resulting from use of a "hot" transistor, too good a line, and too short a line for L1 is detailed in the following. These three things taken together can spell disaster. I just happen to have a reliable oscillator in my minibox which lights a number 48 or 49 bulb with rf, and puts out a good test signal of some 25 mW on 432 MHz. So to check

out the HEP 56 I set up a similar circuit, as shown in Fig. 2, on a 10 x 10 cm piece of copper-clad, and turned it on. Strong oscillations, rf diode meter moving fine, but tuning completely cockeyed! Where was the frequency? Checks with absorption frequency meters showed it at various places between 950 and 110 MHz. As C1 was moved, the output coupling was varied, and R3, the emitter resistor, was changed.

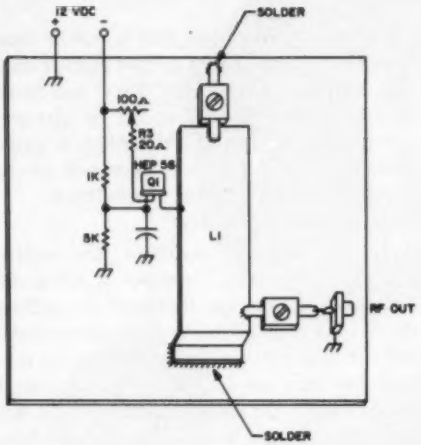

Fig. 2. 432 MHz oscillator circuit to avoid.

L1 and C2 were definitely resonant on 432 MHz, so what was the trouble? After hours went by I finally, in desperation, ripped out the good strap-line L1 and put in a four turn, 6 mm OD coil of number 20 wire in its place. Perfect! Tuned beautifully over the 400 to 500 MHz range, lit a bulb on 432 MHz, coupled out properly, and no trace of oscillation up around 1000 MHz. A straight piece of number 20 wire worked just as well. The original copper strap was just too good, too close to the ground plane, and too wide. All these things promote higher frequencies. L1 was also too short, which made C1 too large, and subsequently made L1 look like it was grounded at both ends. Later tests showed that you can use a strap, but you must make it long enough so that C1 is *small* and it will not jump to the higher mode.

Just as a stunt, the oscillator was tuned up using a regular coil and variable capacitor, shown in Fig. 2. It worked beautifully, tuned up and down over the amater band of 420 to 450 MHz, and even lit a bulb! Suit yourself. You can use either the strapline or the coil. I have both here, but for some reason the idea of a 4 or 5 turn coil tuned by a regular capacitor on 432 MHz fascinates me.

1296 MHz

The Motorola HEP 56 is also adaptable to 1296 MHz. It still oscillates there at one half a mA collector current, with a 6000Ω resistor in the emitter, which we will describe. You do not need to run it that way unless you want low power. That is just one of my tried and true oscillator tests. If an oscillator works at 6 mW dc input and drives a diode meter, it is a good oscillator.

I tried it with a quarter wave line and did get to 1296 MHz but with practically no line left and no tuning possible. Using the half wave circuit of Fig. 3, it tuned from 1200 MHz to above 1500 MHz with the sliding short shown, and handled very nicely.

Semi-Fixed Capacitor Tuning

A number of small ceramic and mica compression trimmers were tried in the position shown by C1 in Fig. 3, but all to no avail. A do-it-yourself C1 worked very well as soon as it was installed. One of the basic principles involved is to be sure that no additional metal touches L1 itself, just have a ground tab come nearer or further away from the center portion of it. If the ground part of C1

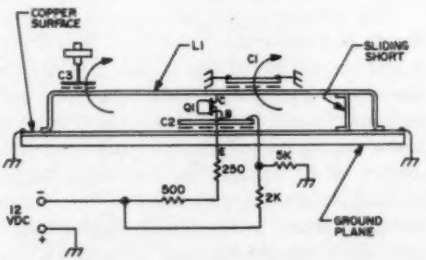

Fig. 3. 1296 MHz oscillator using an HEP 56. L1-10 mm wide copper strap, 90 mm long, spaced 6 mm from ground plane. Sliding short is 57 mm from C3 end. C2 – brass plate, see text. Ground plane is 100 mm sq.

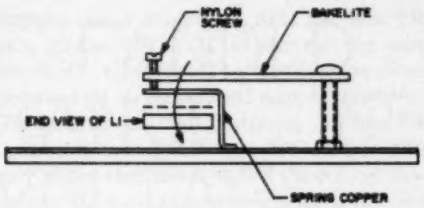

Fig. 4. Spring copper and nylon bolt used for tuning in the 1296 MHz oscillator.

is made of spring copper and a nylon bolt is positioned above it for tuning as shown in Fig. 4, it will do a good job.

Bypass Capacitor Treatment

Cut the baseboard to size by 100 mm smooth and polish it. Cut a 25 mm square piece of brass thick enough to hold itself flat against the smooth baseboard and yet thin enough to solder components to it. This is easier if you bend up two corners as shown in Fig. 5.

Place the brass plate in position, clamp, drill the two holes for the nylon bolts, remove, clean off burrs, flatten, and polish. Mark one side of the plate and the baseboard for later positioning, unless you are a better machinist than I. Position the fiberglass, remove, and cut. I just cut little square holes to fit the nylon bolts with an Exacto knife. It has worked so far. Put the baseboard in a drill vise, and assemble as illustrated in Fig. 6. Every time you do, you can test for rf on it later with the oscillator running and you will not find any. Believe me, it pays to have the base well anchored down.

Emitter

For a good stable oscillator at 1296 MHz there is no need to tune the emitter, although this is useful when you wish to operate at higher power or at its extreme high frequency limit.

Use a good 10W resistor for R and solder it as close as possible to the emitter. Remember that the emitter lead left on, and the lead left on the resistor, both have to oscillate at the fundamental frequency, although this rf voltage will be less than that of the collector in this circuit. Trim up the resistor value with an external pot, and solder in the final value later after tuneup. Note that in doing this you must have some resistor in the emitter circuit to act as an rf choke. You can use a choke but this may cause frequency troubles at first.

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The Collector

The primary thing here is L1 and its position in regard to Q1. I find it fits nicely as shown in Fig. 7. Every one mm left on the base and/or collector leads is important at 1296 MHz. Do not leave any more than

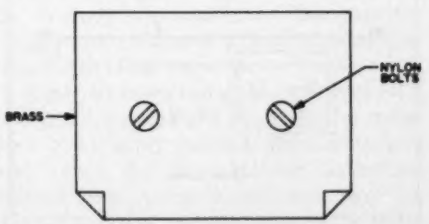

Fig. 5. Bend two corners of the brass for easier construction.

absolutely necessary. Looking at Fig. 7 you will see that things are pretty short here.

So, if you take care of the base, emitter, and collector as outlined above and in Fig. 3, you will have a 1296 MHz oscillator.

2300 MHz

This one you will find to be like the 1296 MHz job, only different. Well, it's this way. There is a transistor in a half wave line, only it's a different transistor, and the other things are treated a little differently also.

Your amateur license allows you to use pulse on this band. More on that later.

The transistor used for this oscillator is one of the KMC 2N2500 series. I find the 2N2501, the 2502, and the H104 all work at this frequency, in fact, most of them go on up to 2500 MHz. The H104 is retailed by Bill Ashby,president of KMC Semiconductor Corporation, for only $5, a bargain.

The schematic is shown in Fig. 8A, the layout in Fig. 8B, and in detail in Fig. 8C.

The actual unit doesn't look bigger than a postage stamp with a thumbscrew holding it down, but it works! It still oscillates and tunes well at 4 mA of collector current, always a good test. The base should be treated in the same fashion as the similar unit of the 1296 MHz oscillator previously described. Note in Fig. 8B that the brass plate unit is located under L1, and crosswise to it. Make the base lead of the transistor very short, no more than 1/16 in. The length of the lead going to R1 and R1 is of no importance. The dc base bias is supplied by R1 and R2. For maximum power output you can use up to 2K to R2, which puts more positive bias on the NPN Q1. Then you will have to push the current up by lowering R3 and R4; or rather, the final value of R3, if you take R4 out after power trimming, will be lower. Watch those mils when you play with these resistors because Q1 can go out in a few milliseconds if you push the current too far.

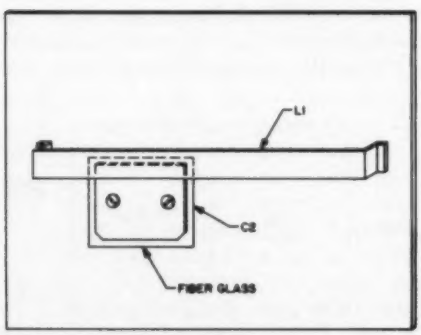

Fig. 6. Illustration of baseboard.

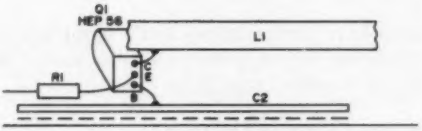

Fig. 7. Q1 assembly detail for 1296 oscillator.

What Not to Do

1. Don't make a 432 MHz collector line that is too short. If you do it is likely to take off on the half wave mode around 900 MHz.
2. Don't make the line too wide. This aggravates condition 1.
3. Don't use a microwave transistor at 432 MHz unless you take precautions. This also can aggravate condition 1.
4. Don't use too high a capacity for C1. This of course stems from number 2 (line too short). The line really looks like a half wave then.
5. Don't couple the output too tight while tuning up.
6. Don't run too much current at first.

What to Do

1. Use a variable emitter resistor and "sneak up" on the output as you tune up.
2. Use enough inductance for L1 so that C1 acts like a small capacity, tuning L1 to a *lower* frequency. If C1 is too large you will simply ground the end of L1 for rf and jump to a higher frequency.
3. Use a half wave circuit from 1296 MHz up. It's better.
4. Use fractional numbers of pF values for tuning and coupling from 1296 MHz and up (e.g. ¼ pF etc.).

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The power line to be monitored is rectified by D_1 and filtered by C_1, R_2 and R_3 form a voltage divider which holds one side of the meter at half of the rectified line voltage. DC is also applied to R_6, the low voltage calibration pot, through a 3W 110V lamp (or equivalent resistor) which functions as a limiting resistor for parallel Zener diode D3 and as a pilot light. Any increase in input voltage causes the voltage at the junction of R_2/R_3 to increase while the voltage at the slider of R_6 remains constant. This voltage change unbalances the bridge formed by R_2/R_3 and the two halves of R_6 and causes the meter to read upscale. R_4 and R_5 act as multipliers to set the span of the 1 mA meter. If for example the monitor is to read 100 to 150V the combination of these two resistors and the meter movement should total 50 kΩ (1000Ω/Volt), D_2 serves to prevent the meter from reading backwards when the line voltage drops below the low calibration point (during a brownout or when the monitor is unplugged from the line).

The meter may be any dc milliammeter up to 5 mA is the value of R_4 is adjusted to allow calibration within the range of the high calibration pot R_5. The Zener diode may be anything from 70 to 100V at 10W. R_2 and R_3 may be anywhere from 8200 to 15K at 2W so long as they are of the same value. They need not be precision types. C_1 may be from 50 to 100 μF at 200V or more. The diodes may be any power silicon with a PIV greater than 200 and rated for at least 100 mA.

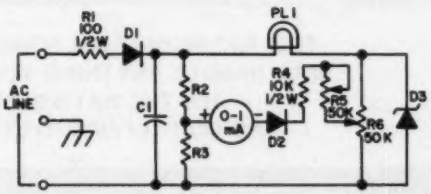

Fig. 1. Schematic of the expanded range line voltage monitor.

Calibration

Set R_6 to approximately center rotation, R_5 to maximum resistance. Then plug the monitor into the power line, allowing one hour for the filter capacitor to "form."

Apply a known voltage at the lowest level you desire to read and adjust R_6 for meter zero. Next, apply the highest voltage desired and adjust R_5 for full scale deflection. Repeat steps 3 and 4 until you have the desired accuracy at both ends of the meter scale.

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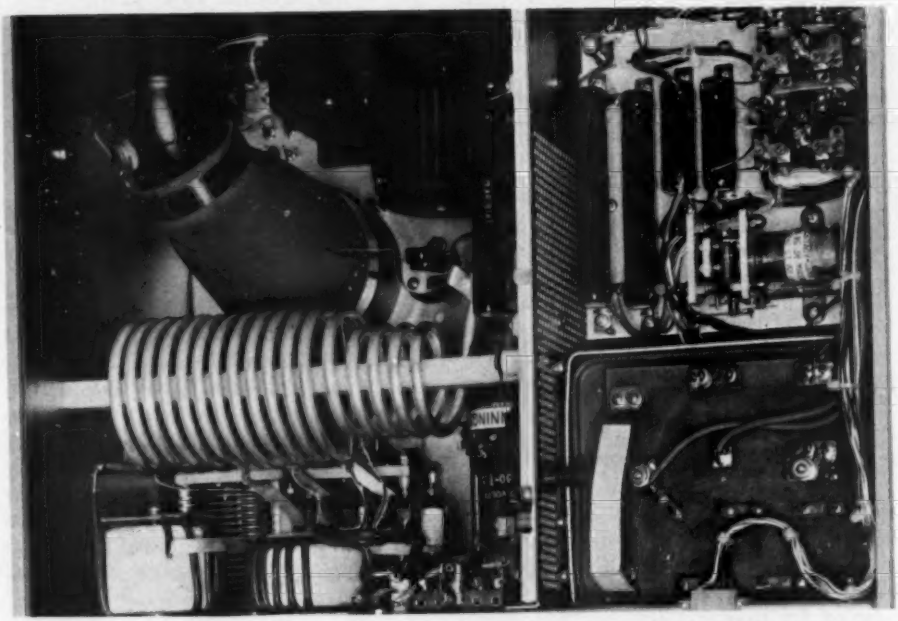

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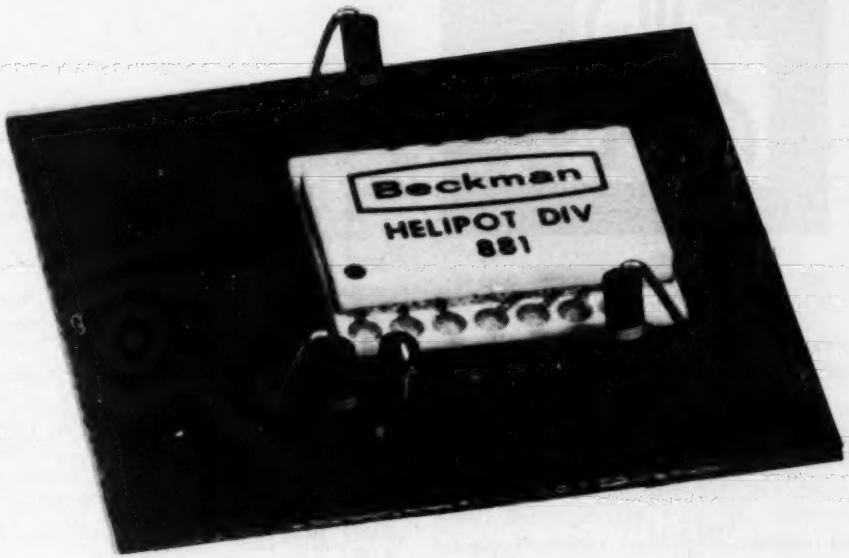

ACTIVE FILTERS

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The Helipot Division of the Beckman Corp. (Beckman Instruments, Helipot Division Fullerton, Calif. 92634) offers their Model 881 ($25 ea.) universal active filter which can be simply constructed and used as a very effective audio bandpass filter for CW reception or as a high or low pass filter for SSB reception. Because the unit is a special, hybrid, integrated circuit device, all of these filter functions can be achieved by selection of only four external resistors and a ± 9V power supply. The resistor values determine the frequency and Q of the filter. The catalog sheet that comes with the filter gives complete data, theoretical performance

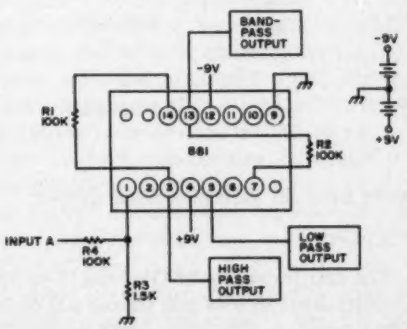

Fig. 1. Connection diagram for the 881 filter.

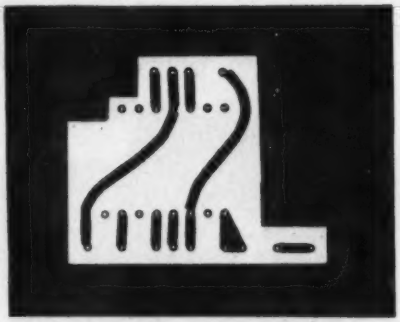

Fig. 2. Full size template (copper side) of the circuit board.

curves and formula to be used for resistor selection.

Fig. 1 shows the connection diagrams for the filter described in this article. For the filter tested the resistor values are:

$$R1 = R2 = \frac{5.04 \times 10^7}{F}$$ center frequency, unity gain

$$R3 = \frac{100K}{(3.48 \times Q)-2}$$ band pass

$$R3 = \frac{100K}{(3.16 \times Q)-1}$$ low pass

R4 = 100K band pass

$$R4 = \frac{316K}{Q}$$ low pass

$$Q = \frac{F}{\Delta F}$$ band pass

where ΔF is the -6dB bandwidth desired.

The unit is capable of Q's from .5 to 50. A center frequency of 500 Hz and a Q of 50 would yield a CW filter with a 10 Hz bandwidth; really too narrow for normal CW reception.

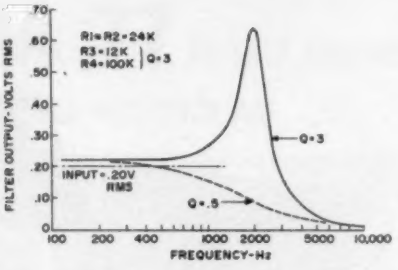

Fig. 3. Characteristics of the 881 used as a low pass filter.

Fig. 2 is a full size template for the printed circuit board and the photograph shows parts placement.

The experimental data obtained with the low pass filter is shown in Fig. 3. Note that a low Q is required for a low pass filter if ringing or voice distortion is to be avoided at the cut off frequency. From the data shown by Fig.3 the optimum Q for a SSB low pass audio filter would be approximately Q = 1.00.

The experimental data for the bandpass version of the filter is shown in Fig. 4. The calculated center frequency was 500 Hz and measured center frequency was 505 Hz. The measured $Q = F/\Delta F = 505/80 = 6.3$ was a bit lower than the calculated Q of 10, however the agreement with the theory is still very good considering that ± 5% resistors were used.

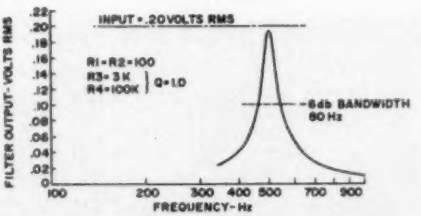

Fig. 4. Characteristics of the 881 used as a bandpass filter.

If R1, and R2 were ganged potentiometers, one could track or peak a signal independent of receiver tuning. The simplicity of the circuitry should offer no construction problems and the size is small enough for QRP transceivers.

. . .W6AGX

Henry B. Ruh WB8HEE
140 Ash
Whitmore Lake MI 48189

VIDEO TAPE RECORDERS

The Lone Ranger rides AGAIN?

Having been a prisoner of the nightly parade of TV sports programs, and a devoté of good movies from the classic, *King Kong to The Thomas Crown Affair,* I've been severly bitten by the wonders of video tape. In keeping with my fond memories of TV programs long lost to the archives of program vaults hidden in TV station basements across the nation, be they *Kukla, Fran and Ollie,* or Edward R. Murrow's *Person to Person, Star Trek* or *The Man From U.N.C.L.E.* it seems only natural to at last own my own video tape recorder for fun and fortune.

There is a growing awareness on the part of TV vidiots (people addicted to TV) of a marvelous machine called a video tape recorder. With it one can record and store the sights and sounds that please us now for enjoyment later. There's nothing quite like watching a good movie after a long day at work (especially when you get home at 3 AM) without having the commercials add to your humdrum (having recorded the program and edited out the beasts).

While the professional VTR's cost upwards of $65,000 there are many inexpensive units on the market; new, used, and surplus which can be had for a reasonable sum. Typically $500 for a black and white and $1,500 for color. These have all sorts of exotic extras depending on what you find and where. Stop action, slow motion, editing, color, audio dubbing, automatic gain control and other features can be found on machines which are suitable for home use. The video recorders are manufactured by many different companies such as Concord, Sony, Shibaden, IVC, Ampex, Akai and others. Each has a different format, and offers different features for your money.

Not being richly endowed, I opted for an excellent black and white VTR which had a good many features and quality for the nominal sum of $450 plus tax and shipping. I was also able to obtain a TV-monitor, a Panasonic TR-900V which is made for use with a home VTR, and is a regular 82-channel TV as well; it even works from 12V dc. A connector on the side of the TV and a switch next to the connector select normal or VTR modes, and it uses a standard cable to mate with the popular home VTR units now on the market. There are a lot of other models around from almost every manufacturer, color and black and white, and they cost a little more than a regular TV. Not all TV stores know of these models, so you may have to do a little looking, or contact the manufacturer of your choice direct. No need to worry, though, since the necessary signals, audio and video, can be found in most TV's anyway.

After smuggling the goodies into the house to avoid the cries of the YL (you never buy *me* anything) and hustling into the laboratory (ham shack) I unboxed my

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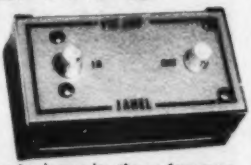

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FM	100PB	88-108 MHz
TV	TV-PB	Ch 2-13 (Specify)
High Band	160PB	146-174 MHz
432 MHz	432PA	432-438 MHz
440 ATV	432PA-T	435-445 MHz
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treasures to see just what I really had. Low and behold, a gleaming black and chrome 60 pound box with knobs, lights, meter, switches, connectors, level and, thank God, an instruction book. After reading the book and messing around for a few minutes, I was astounded to discover that using a video tape recorder was like using any ordinary audio recorder. The record function was a simple button. The level meter and knob was just like the VU meter on my stereo, and the connections amounted to a TV lead to the TV and a single cord from the TV to the recorder. The Shibaden unit I purchased has a switch on the front to select the TV or a Camera input, and a simple diagram on the lid helps you thread the tape. Nothing fancy, just around the tension arm, past the erase head, around the video head drum, past the audio heads, between the capstan and pinch roller and onto the take up reel.

After a few hours behind closed doors to build up my confidence, I braved the YL's scorn and took the unit into the living room. I set it up to show it (and me) off to the family. What do you know! She *liked* it! In a few weeks we had accumulated a closet shelf full of commercial free movies, a *Charlie Brown* program for the kids and a few goodies from some other fellows who have a unit similar to mine.

I didn't think that home VTR's were popular until I owned one myself. Since then I've bumped into lots of folks at recreation vehicle get-togethers, swap and shops, camp outs and other places who have and enjoy home video recording. While talking to other users I found a CAP official who uses his to document air crashes and pilot check flights. He says that a low flyby with the camera out the cockpit window gives a better idea of what happened than a few still shots of the crash debris. He also has a copy of *King Kong* in his library or taped programs. A realtor in the neighboring town advertises his "video listing service" and shows clients his listings in the comfort of his office while they drink coffee. He said that it saves him a lot of time and money rather than taking clients around to different houses all over the area only to find that they aren't really interested in any of them. A record shop uses a video recorder and camera to thwart shoplifters, and recently a national magazine I receive told of the Wisconsin State Police using video tape recorders in patrol cars to record drunk drivers. According to this article they have nearly a 100% conviction rate. I guess one look at themselves wandering all over the road convinces them that they really are drunk.

After you've had a VTR for a while you will be looking for a cheap source of tape. Most home units use ½ inch wide tape, and the electronic parts houses like Allied, Newark and others charge about $39 per hour reel. A few places discount the tape and used tape can be had for as little as $10 for an hour reel. This is a heck of a lot cheaper than film. Especially when you consider that you can re-use the tape over and over again. Communications Unlimited in Whitmore Lake, Michigan, advertises new tape for $25 per reel which is the cheapest I've found. They frequently have used tape as well. In a pinch, it's available most anywhere from companies which sell or service video equipment, who are usually

found in the yellow pages under video recorders and video recording services. The very cheap and commonly available computer tape is very abrasive and will wear out your heads quickly, so caveat emptor.

Since we've had the video tape unit, we've sold our movie camera. We found that had more enjoyment at less cost with the video tape than with the film. We've purchased a lot of film over the years, and most of it has collected dust in a bedroom closet. It seems so bothersome to haul out the projector, screen, cans of film, wait until after dark, find out the bulb is burned out and postpone until the next night the seventy-third showing of Susie and Jeannie at Yellowstone at age 4. With the tape unit we can show any of the tapes anytime, just turn on the TV, sit back and enjoy. When we get tired of a program or some home "movies" of the kids and kin, we can erase and rerecord the tape as much as we like. We put about 200 passes on one tape when the wife decided to learn how to golf, and we used it to help her develop her swing and style.

We live near a lake, and a professional water ski team practises here often. One day the chief honcho noticed my camera and portable recorder and asked if I would record their tricks and play them back so they could see themselves and help them correct some problems in a few of their tricks. At the tune of $10 per hour they enjoyed themselves (as did I) and despite a few compromising shots.with the zoom lens, they glady paid (PAID!) for the use of my equipment. That did it. Before you knew it my greed overcame me, and I set about finding all sorts of profitable uses for the VTR. Between taking depositions for lawyers and shooting the duffers on the practice tee. The wife now complains that I'm not paying enough attention to my ham radio!, and a few other items, like mowing the lawn. Oh well. It's a lot of fun, and my whole family enjoys it immensely. If you haven't yet been bitten, don't wait, go find the bug. It's cheaper than 7 nights of TV and beer.

Now if you can't find, or don't want to buy a separate TV to go with your recorder, you can frequently modify your present TV to work with your VTR. The recorder needs a video signal and an audio signal. The video can frequently be found in sufficient quantity right on the output side of the video detector diode. Take the video out through a large (100-500 μF electrolytic capacitor) value capacitor. You need 1-4V of video with negative going sync. This is the normal signal found at the video detector. The audio can frequently be taken from the speaker leads or earphone jack. The VTR puts out a signal of about 1V video and about 1V audio. You can usually tap the audio back into the TV just ahead of the volume control. Use a .01 μF capacitor for coupling and dc isolation. The video circuits in some TV's need 4-10V of signal to produce normal contrast on the screen, so you may have to turn up the contrast on the TV during playback. Since no two TV sets use the same circuit a little trial and error will be necessary to get suitable results. If you have a black and white recorder it makes no difference if the TV is color or not, you just won't see the color during playback. If you have a color recorder, obviously you need a color TV or monitor.

Most recorders "loop through" the video and audio during record or "standby" and this is very useful as you can see what your recording will look like and can adjust the record level accordingly. Most recorders are well enough designed that you would really need a whopping big signal to cause an over deviated signal and poor recording. (VTR's use a single sideband FM signal to record the video signal). If you do hook to your own TV, don't use a "hot" chassis set or series filament TV. This can put ac between the recorder and TV. Use shielded cable for audio and video (72 ohm coax is best for the video) and use coupling capacitors in series with all signals to prevent dc voltages from ruining any transistors at either end. For added help, check the schematic of a TV made for VTR use like a Panasonic TR900V (transistor circuit) or AN69V (tube circuit). Magnavox, RCA and others also make VTR capable TV's, so if you are about to buy a new TV, spend the few extra dollars to get the capability, you'll enjoy it that much more.

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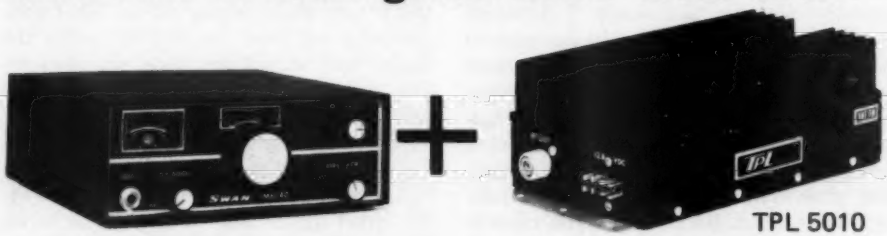

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Most decimal counting units in use today employ the familiar TTL logic IC's in combination with a nixie tube or some type of seven segment readout. The cost per decade of this type of circuitry is $10 and up (considerably more in Canada). The parts for the unit described herein cost about $2.50 per decade plus about $5.00 for associated circuitry; so a 5 decade counter would cost roughly $5.00 + 5 X $2.50 = $17.50. The counter has a few limitations which will be covered later.

How It Works

The events to be counted must first be converted into a voltage level that drops abruptly by several volts at the occurrence of each event. This negative going transition triggers the monostable multivibrator (Fig. 1) which produces a pulse of standardized width (about 1 microsecond). The pulse is inverted by Q3 and delivered to Q4. Q4 is non-conducting until the arrival of a pulse. During the pulse Q4 acts as a constant

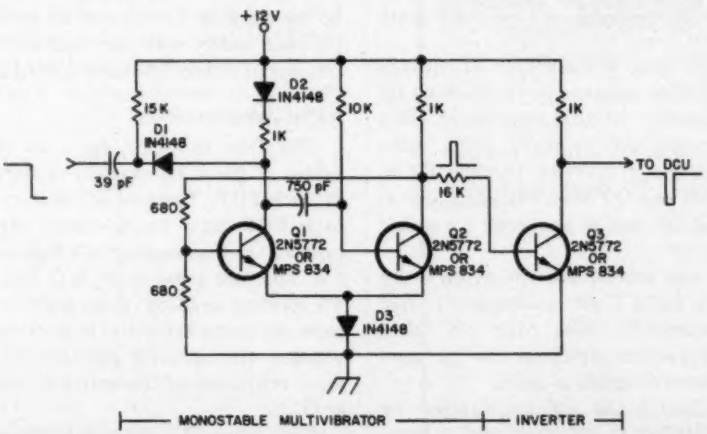

Fig. 1. The input stage converts the negative going event signal into pulses of standardized width.

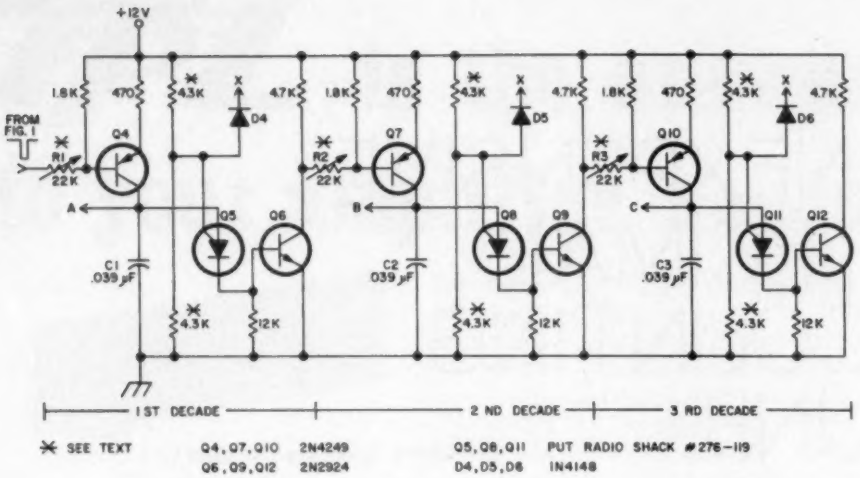

Fig. 2. The circuitry of the three counting decades.

current source to charge C1. With the arrival of each new pulse the voltage across C1 increases step-wise by equal increments until it reaches about 6V; then the programmable unijunction transistor Q5 fires and abruptly discharges C1. The 4.3K resistors at the gate of Q5 fires and abruptly discharges C1. The 4.3K resistors at the gate of Q5 set the voltage at which Q5 fires (hence the name "programmable"). By adjusting R1 one can adjust the magnitude of the collector current that charges C1 and by this means one adjusts the number of pulses required to reach the firing potential of Q5. R1 is thus set so that Q5 discharges C1 on every tenth pulse.

When Q5 fires, it discharges C1 through the base emitter junction of Q6, turning Q6 on momentarily. At the collector of Q6 a brief (microsecond) negative going pulse results and this is delivered through R2 to Q7. Q7, Q8, and Q9 work the same way as Q4, Q5 and Q6, but at one-tenth the speed, of course.

So C2 will accumulate charge on every tenth pulse and C3 will accumulate charge on every hundredth pulse. After 999 pulses all three capacitors discharge on the next pulse and everything starts again.

Since C1, C2 and C3 are charged by constant currents the voltages across them will be directly proportional to the number of pulses that have arrived. These voltages can be easily measured, without discharging the capacitors in the process, by means of thes high input impedance electrometer in Fig. 4. By pressing S1, S2 or S3 the voltage across a particular capacitor is applied to the gate of the FET. This controls the source current which in turn controls the reading on the microammeter. By adjusting the zero set and calibration controls in Fig. 4 the voltage across C1 after 3 pulses, for example, can be made to correspond to 3 divisions on the meter scale and 8 pulses will then correspond to 8 divisions on the meter scale. So by pressing S3, S2 and S1 in succession (in that order) one can read off the total number of pulses that have arrived at Q4.

Initial Adjustments

The first thing to do is to check the values of the 4.3K resistors in the gate lead of each PUT. The pair of resistors used for each PUT must be as nearly identical as possible so that each gate is held at exactly 6V. The best thing to do is to buy about 8 5% resistors and from them select 3 matched pairs with an ohmmeter. It does not matter whether the matched pair for Q5 has the same resistance as the matched pair for Q8 or Q11.

Next adjust R1, R2 and R3 to mid value approximately.

The microammeter shown in Fig. 4 can be your multimeter or any sensitive meter; it need not be 50 μA. It must have a uniform scale of numbers from 0 to 10 (actually only 0 to 9 is used but most meters go from 0 to 10 and there's no point pasting on a new scale). I set my multimeter to the 50 microamp scale and then I used the 0 to 10V scale to make my readings.

Approximate settings for the calibration control and zero set may be made as follows (see Fig. 4); with the 12V supply turned on connect the gate of the FET to a potential of 1.2V and adjust the zero set until the microammeter reads zero. The reason zero reading does not correspond to zero volts on the gate is that Q5, Q8 and Q11 do not completely discharge C1, C2 and C3 respectively when they fire. Next connect the gate of the FET to a 6.0V potential and adjust the calibration control so that the meter reads 9.

Next connect a square wave, sawtooth wave or pulse source to the monostable multivibrator in Fig. 1. The waveform used must fall abruptly by several volts each cycle. The SN7400 series TTL circuits will drive this nicely. If you have an oscilloscope with a sawtooth available at the front panel this will do nicely. Or you can make a simple UJT relaxation oscillator to produce pulses. Select a frequency of about 1 Hz and by depressing S2 you can watch on the microammeter the arrival of each pulse. Count the number of pulses that are stored on C1 before it discharges. Adjust R1 so that 9 pulses arrive and are stored on C1 and then C1 should discharge on the arrival of the tenth pulse. It may be necessary to add some

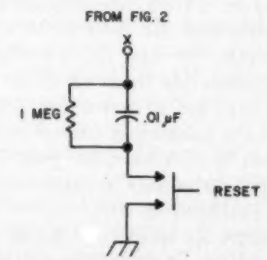

Fig. 3. The reset switch for zeroing the counter. It must be pushed four times.

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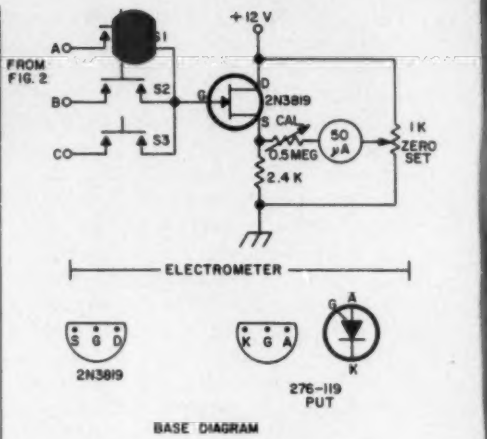

Fig. 4. The output of each decade is indicated separately on the calibrated meter by pushing the appropriate switch.

fixed resistance in series with R1 if Q4 has exceptionally large gain. But since the adjustment of R1 is very sensitive I do not recommend using a larger *variable* resistance. This adjustment of R1 is easily done with an oscilloscope, if you have one. The procedure would be to connect the scope to the source lead of the FET and depress S1. With an input frequency between 60 Hz and 10 kHz to the monostable multi, you should get a staircase wave and by adjusting R1 you can select the proper number of steps as shown in Fig. 5.

After adjusting R1 you may have to make a final adjustment to the zero set and calibration controls (Fig. 4). Always adjust the zero set first; this is done with a low frequency signal applied as above. Wait until C1 has gone through 10 pulses and has been discharged by Q5; quickly remove the signal by disconnecting the pulse input at R1 so that the zero set can be carefully made. Then reconnect the pulse input to R1 and wait for 9 pulses to arrive and disconnect again. Set the calibration control so that the meter reads 9. Reconnect the pulse input. It should not be necessary to further adjust the zero set or calibration.

Next press S2 and adjust R2 so that C2 stores 9 pulses and discharges on the tenth. It will be necessary to increase the frequency of the signal input to the monostable to

about 10 Hz because the first decade will divide this by 10 and give pulses at 1 Hz as input to the second decade. If it is found that the meter doesn't quite read 9 on the 9th pulse, this must be corrected by a slight readjustment of R2.

R3 is adjusted next in the same manner but in this case the signal input should be around 100 Hz.

Additional Notes

It might appear that Q12 serves no purpose. It must be included however because Q11 must discharge through the base-emitter junction of Q12, just as Q5 and Q8 discharge. If Q11 is allowed to discharge in a different manner from Q5 and Q8, C3 will discharge to a different "zero" from C1 and C2.

To reset all decades to zero the circuit in Fig. 3 is used. It temporarily reduces the gate voltage of each PUT to zero causing them to fire. The reset button must be pressed 4 times to encusre that all decades reset to zero.

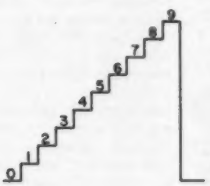

Fig. 5. The value of R1 in Fig. 2 is adjusted to produce this staircase wave at the source of the output FET.

Transistors Q4, Q7 and C10 must have very low leakage in the off state, of course, otherwise C1, C2 and C3 will be charged up by this leakage current; the 2N4249 was chosen for its very low leakage and low cost. Very few transistors combine these two qualities. Similarly Q5, Q8 and Q11 have very low leakage in the off state so as not to discharge C1, C2 and C3.

For switches S1, S2 and S3 it would be better to use a rotary nonshorting switch rather than push buttons but I was unable to obtain one. With push buttons, which are cheaper, the meter often drifts off scale when none of the switches is being depressed.

C1, C2 and C3 would be polystyrene, polycarbonate or metalized polycarbonate types because these types exhibit low leakage and metal capacitance change with aging.

A regulated 12V supply at 100 mA should easily take care of the power requirements to run this.

Limitations

The main limitation of this counting circuit is its low speed. The upper limit is around 25 kHz. Q5, Q8 and Q11 limit the speed in that they cannot discharge C1, C2 and C3 very quickly. If these capacitances are reduced to obtain greater speed you find that leakage currents from the transistors are more easily able to change the charge on these capacitors and the meter readings become unreliable. With a 25 kHz frequency limit you can always scale down a frequency of 1 MHz say to 10 kHz with some SN7490 ICs and then measure this. However you are limited to 5 figure accuracy by this method; if you wait 1 second for a measurement the counter would only get up to 10,000 in this time. To get 6 figure accuracy you havesto count for 10 seconds and that's just too long for most people. Speed is no problem if you're measuring period of time intervals of a few seconds. For example suppose you feed in a 10 kHz signal to the counting unit and you have some event gate it on for about 2 seconds, say; you could get the length of time for the event to the nearest 1/10,000 of a second. It might be 2.1037 seconds. This is probably more accuracy than anyone would ever need.

In Fig. 4 three decades are shown. The practical limit is 5 decades. A sixth decade would count so slowly that the charge on its capacitor would partially leak off between pulses. Incidentally, an accumulated count should be read within 30 seconds or else the readings may begin to drift up or down; 30 seconds is lots of time for a reading.

In summing up we have a very inexpensives counter that consumes little power and is TTL compatible. It requires some initial adjustment and has relatively low speed.

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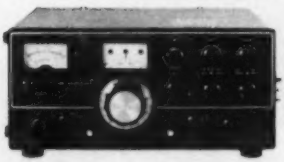

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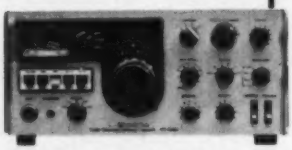

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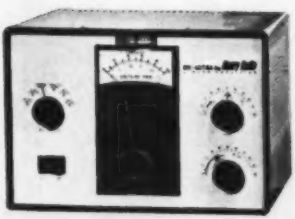
. . . a winning pair!



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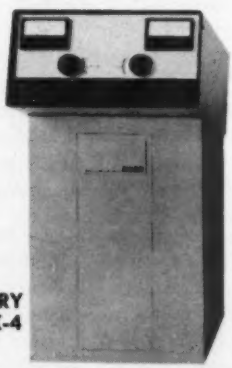

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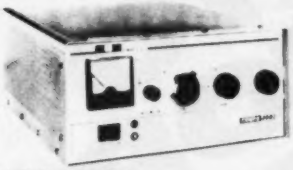

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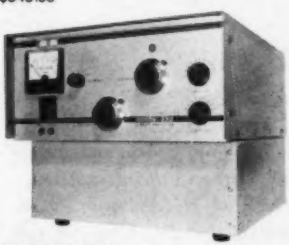

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TEMPO/CL-146

The CL-146 offers operation on the 146 MHz amateur band. The price includes a microphone, power cord, mounting bracket and one pair of crystals. A full line of accessories is also available.

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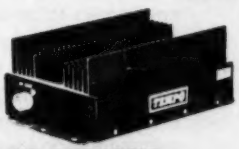

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WHISTLE UP A QSO

With a Krazy Keyless Keyer

The title of this article can be taken quite literally. Whistle, hum, speak or play a tape to key your transmitter.

Although the original motiviation behind the development of the Krazy Keyless Keyer was my own inherent laziness, it ultimately became an extremely useful asset to the CW operation of my shack.

Three items interfere with my full enjoyment of a CW contact; the first is the repetitious CQ calling; second, the inevitable repetitious description of my shack, its equipment, my name and QTH, etc., etc., and lastly sending and resending a lengthy message.

The fact that I unfortunately positioned my telegraphic mill on the right side of my desk causing me to reach over around and behind the mill during rapid QSO's was yet another reason for me to wish that I could somehow key the transmitter with the microphone attached to my earphones.

The problem was to turn audio output into an instrument to make and break a mechanical contact. The answer came accidentally while fooling around with a three channel color organ which used a transformer with a resonant capacitor to gate a 120V scr thus lighting appropriate lights. If it would turn on a light, it should turn on an ac relay. It did and it does.

T1 is a salvaged driver transformer from a junked transistor radio. Normally there are two transformers in these small radios, one is yellow – the other blue – and the blue one is usually the driver with a 5:1 impedance ratio. The dc resistance measures approximately 100–200Ω on one side (make this the primary) and 500–600Ω on the other.

C1 forms the resonant frequency somewhere in the mid-range of the audio spectrum. It can be increased or decreased to accommodate your tape recorder output or the tone you prefer when recording. C2 can be increased to improve sensitivity. The relay should be a 105–125V ac relay. R2 is a current limiting resistor to the ac relay. C3 provides voltage to the relay during the half cycle that the scr is off.

Hash from the scr is minimized by the 1 KΩ resistor and none was noted during operation of the unit. Any key clicks that

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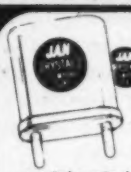

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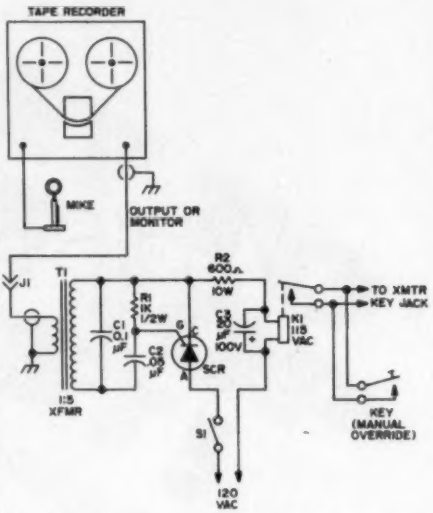

Fig. 1. The Krazy Keyless Keyer in all its glory!

you may have had with a normal key will probably still be present and an appropriate key click filter should be added to the relay contacts.

If junk or salvaged parts aren't available, commercial units can be used. The transformer would be a Radio Shack driver (273-1378) primary 10K secondary 2K (reverse when putting in keyer). SCR Radio Shack's 276-1067, GE-ZI or C106 will work. C1 is approximately .1 μF paper, C2 is a .01 or higher ceramic or paper. R1 is a 1 KΩ ½W and R2 is a 600Ω 10W resistor.

Any tape recorder may be used. I use a cassette type with a monitor jack. The monitor is not essential, but unless you have a side tone in the transmitter, you should have some way of telling what's being sent. A home-brew sidetone can, of course, be connected to the relay.

Now, with a stock of caller tapes, record opening QSO information and a goodly portion of canned information, jokes and sea stories on separate cassettes, I can simply assume a horizontal position and have quite a CW contact.

If someone will just come up with a perfect coffee maker I will attain complete inertia!

. . . K1YSD

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Here we will detail the breadboarding, circuit design, padding for 2 MHz full dial spread and coverage, and results on ten meters.

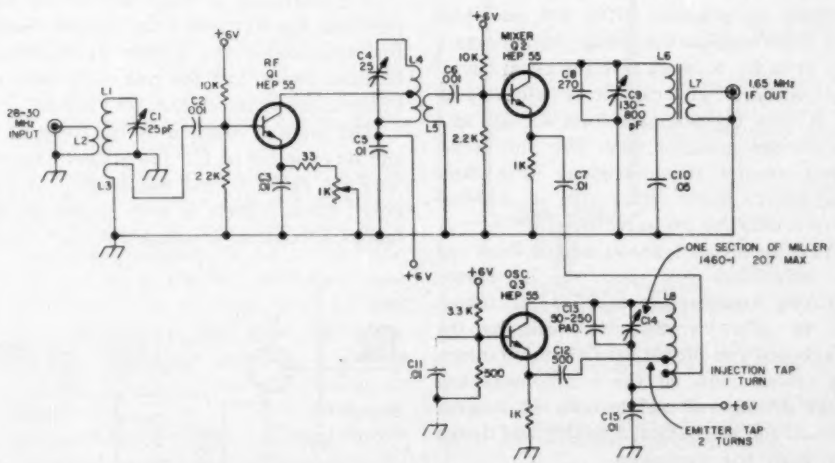

Fig. 1. Overall converter schematic. L1, 17 turns, 15 mm OD, 25 mm long; L2, 3 turns on cold end of L1; L3, 1 turn on cold end of L1; L4, 11 turns, 8 mm OD, 35 mm long; L5, 2 turns on cold end of L4; L6, 21 turns No. 30 inside cup core from Millen 10C; L7, 4 turns No. 30 wound over L6; L8, 5 turns, 15 mm OD, 8 mm long, mixer tap at 1 turn, and emitter tap at 2 turns from ground.

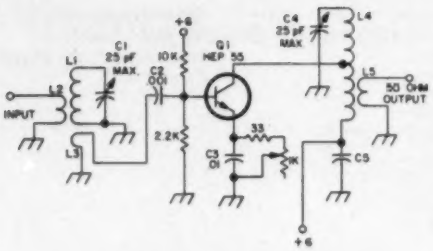

Fig. 2. Rf stage, ten meters.

The *method* of testing is stressed, so you can use components that you have on hand.

The Overall Circuit

Figure 1 shows what we have. All three stages have been worked on extensively to provide a maximum possible guarantee that it will operate correctly when you build it. The rf stage has been engineered to prevent self-oscillation, the mixer for good gain and freedom from pulling on the oscillator, and the oscillator for high reserve power.

Using the components specified and the exact circuit, you will find that it handles extremely well, without a trace of oscillation in the rf stage, and tracking is made easy by the smooth tuning of all three circuits.

The Breadboard Setup

Quite an extensive affair was assembled with three separate but similar tuning capacitors in order to work out the exact circuit itself with coil and capacitors before building it into the compact form for use as a mobile and portable unit. The unit is designed around that intriguing little three gang job by Miller (their part No. 1460-1) which is only 2.5 cm wide!

This breadboard allows you to work out the inductance you need, the impedance matching windings and taps, the dc values, etc. In other words, after finishing the breadboard you should have a smooth-operating circuit with all the components and values determined and be able to concentrate on the mechanical assembly and design you want for packaging

With this breadboard layout you can work out any variations you have in mind, or substitutions of similar components, and check their operation before final assembly.

The Rf Stage, 28–30 MHz Requirements

Two tuned circuits, reasonable gain, good noise figure, very good tracking capability and padding, freedom from self-oscillation, input and output impedance matching.

One of the things that is interesting in a transistor rf stage is the question of feedback causing self-oscillation. The engineers working hard to produce good devices have a parameter called "reverse transconductance." In plain English this is simply the old devil built-in internal feedback, collector to base – exactly the thing you *don't* want. You've seen it before in triode tubes if you're of that age, and it is simply the same as the old plate-to-grid capacity all over again, plus some resistance thrown in to make it a little tougher to lick.

Manufacturers claim certain IC's reduce this effect way down, but right now, working with a single $1.20 transistor, we're back close to the neutralization business again. Another nasty feasture of this is the *rise* of this nuisance with frequency.

We place a lot of faith in adjusting the base winding, or tap, to avoid this condition, having used this method with success on 1.65 MHz. This faith was justified, as you will see, at least for 28–30 MHz.

A breadboard rf stage was set up with care (see Fig. 6) to allow the needed changes for determining the proper parameters as outlined above, and this one really paid off. Figure 2 shows the circuit, with details.

The input is adjusted by the turns of L1 and its coupling to L2. Input tuning is done with L2 and C1, and the amount of base input drive, which is very important for feedback control, is adjusted by L3. A tap

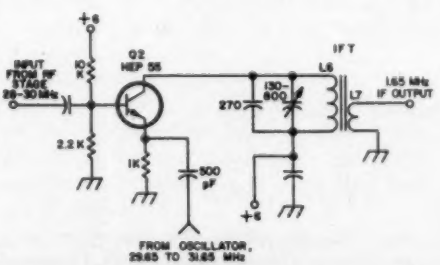

Fig. 3. Mixer stage.

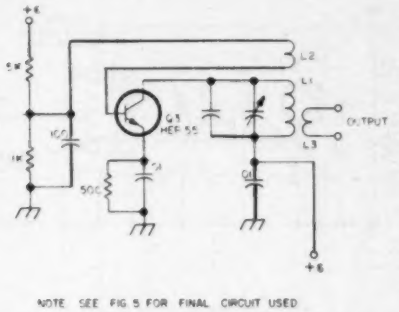

Fig. 4. First oscillator.

on L2 also works, but the single turn coil L3 is easier to adjust, so it was used in the final circuit.

The transistor used is of course our "Universal" one, the Motorola HEP 55 which is turning out to be a real low noise one, as well as universal. The emitter bias is temporarily adjustable, with a limit resistor R3 as well as a pot of 1K. Base bias is supplied with the usual 10K and 2K resistors and isolated from L3 by C2. The collector is tapped onto L4, which is tuned by C4. L5 couples the amplified rf out to the next stage or to a receiver if you are using this unit as a preamp.

Here are the results:

A. The collector tap has little or no influence on the amount of feedback causing oscillation. It does have an effect on bandwidth and tuning and thus a little on image suppression, but not much on gain. It is not critical.

B. The base tap, or size of L3 and its coupling to L2 has a very large effect on the feedback. A one turn loop with adjustable coupling to L2 around the cold end seems the best. With two turns for L3 oscillation occurs when L2 and L4 are tuned to the same frequency. With one turn none took place, and there was still plenty of gain. The present, or breadboard, L2 is 17 turns air-wound, 14mm OD, 6 turns per cm; however this is not yet padded for bandspread on the dial for 2 MHz.

Two types of tests were run on this rf stage, the first as a preamp in front of my lab receiver. This was really amazing. With

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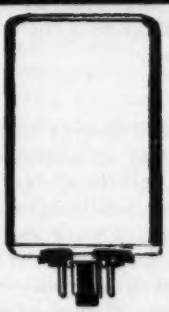

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the rf stage in front, stations were coming in readable that could not even be heard without it. This was on the good old "100 ft piece of wire" by the way.

Gain

Note this point. The difference with and without this stage being so noticeable, I disconnected the receiver entirely and just used the rf stage with a tuned diode detector and a $5 Lafayette audio. I heard about six stations on ten meters with this *one* rf stage and diode detector without any other receiver! Enough on the gain. You don't really need all that much anyway, but it's nice to know it's there.

Good freedom from spurious was noted, due to the filter action of the two tuned circuits on ten, L2 and L4.

As usual, this one stage took over an entire day to build, tune, adjust and confirm. The results are certainly well worth while though, and the unit also worked fine as the rf stage of the tunable converter, as you will see later.

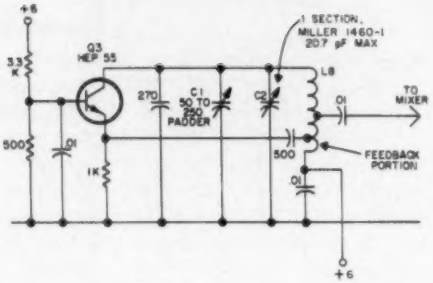

Fig. 5. Final oscillator, 29.65 to 31.65 MHz.

The Mixer

This transistor (refer to Fig. 3) is base-coupled to the rf collector circuit, and oscillator injection is brought in to the emitter. The collector is then tuned to the lower beat note of 1.65 MHz and sent out to the i-f strip, or to your lab receiver for testing. A tuned diode on 1.65 MHz is also good for testing purposes.

Sounds easy. There are a few little details though. Oscillator injection is one. Where to bring it in, how much, oscillator "pulling" also, which is a change in the oscillator frequency due to the effect of the mixer base tuning.

Going through Fig. 3 in detail we have a common emitter connection with signal applied to the base through L2 which is not critical. L1 is the preceding stage collector coil. R1 and R2 establish the base bias, and R3 the emitter bias.

Note that while the emitter resistor may not appear to be bypassed, it actually is, as reference to the whole circuit, Fig. 1 and the oscillator circuit Fig. 5 shows. The injection lead has a .01 capacitor in it and the other side of this capacitor is connected to ground through a one turn portion of the oscillator coil which constitutes a low impedance connection to ground at ten meters. Thus the oscillator energy is brought into the mixer through the emitter and will be found quite free from frequency pulling when the mixer is tuned.

The mixer collector goes to T1, primary of which is tuned to 1.65 MHz. Keep in mind that a ten meter signal and the local oscillator used – when beating together in a

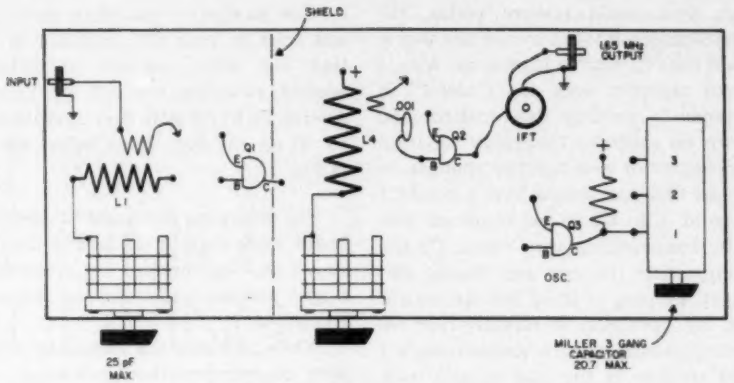

Fig. 6. Layout, 10 meter front end, breadboard.

mixer – always produce four frequencies. In this case they are:

1. The signal on 28 MHz
2. The oscillator on 29.65
3. The oscillator plus the signal, 57.65 (not used)
4. The oscillator minus the signal (used as the i-f)

Number 4 is sent out to the i-f strip on L7. And that's that for the mixer.

The Oscillator

I'm certainly not a fanatic on regulated supplies but this oscillator stage is generally used in the ten meter tube receivers. However, with battery operation maybe we don't need one. So far it looks as though we can do without it.

A common trouble in ten meter receivers in the past has been loss of oscillation with age. The oscillator *must* have plenty of reserve power and yet not produce strong harmonics. This may not be easy because all ordinary local oscillators are class C jobs and operate with plenty of harmonics.

Good shielding and plenty of in-band signal from more than one rf stage can always be used to swamp out spurious in most cases.

The first oscillator used is shown in Fig. 4. This one is our standby for fixed tuned jobs, but it gave trouble right away. So I must have changed something. I had. Instead of putting the collector on the high end of L1 I tapped it down on the coil for tracking purposes, the idea being to use a set of three similar coils all alike with base and collector tapped down to avoid dissimilar tuning. Nice theory but it didn't work too well. Squegging appeared on part of the tuning range which is a real menace. This is also known, by the way, as superregeneration when properly regulated, but we don't want it here either! After restoring the collector to the high end of the oscillator coil we checked the whole operation and worked on the padding capacity needed to cut down the tuning range to the desired 2 MHz, plus a little extra for dial ends. The conclusion reached was to change the oscillator circuit. Never mind that stuff about "horses in the middle of the stream," there are times when all things call for a change, and you *have* to go to another circuit. When a large tuning range or a lot of padding are needed, the circuit of Fig. 5 is best, and it turned out very well here. The main feature is that the entire oscillator inductance is tuned, *including* the feedback portion. Note in Fig. 5 that this part of the coil is in the coil itself and therefore it tuned along with the rest of the coil. The presence of a large capacity, C1 and C2 directly across the coil tends to maintain the desired out-of-phase relation between the base and the collector.

With a given variable capacitor you may have to use a lot of capacity padding in order to spread 2 MHz over the dial.

Although you could remove plates, the Miller three gang job looks so nice the way it is I would hate to start cutting it up. Also, a large fixed capacitor such as C1 and C2 in Fig. 5 tends to stabilize the oscillator and cuts down on oscillator frequency variation due to collector or base capacity changes. In order to do this you should have a *good* C1 and a good C2. C1 is air-insulated and cannot be improved on very much. C2 is a mica-compression trimmer and should also be all right, keeping in mind that we are not shooting for operation in military-type below-freezing-to-boiling-water environments. I have had trouble in the past though with High-K dielectric capacitors shifting right out of the i-f passband when getting out of a warm car into the breeze on a hill-top in the fall. So keep that in mind.

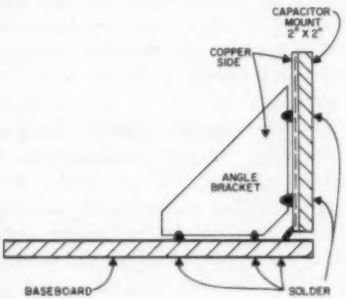

Fig. 7. Capacitor mounting.

The oscillator of Fig. 5 appears to be one of the best I've made yet. The circuit itself I might say is quite standard and is used in a number of commercially produced receivers. It is so stable and so well bandspread in this case that foreign ten-meter stations can be easily tuned in using a small knob without any slow motion attached.

Layout

Should you wish to test some slightly different components on hand, or wish to try some circuit variation, etc., the layout of the breadboard is given in Fig. 6. Plenty of space is allocated for each of these stages, and yet they are close enough so that the leads interconnecting them are not too long for ten meters.

One section of the three gang capacitor was used to tune the oscillator in order to find out what amount of padding was needed, as well as the coil, for spreading the desired 28 to 30 MHz over approximately 10 to 90 on the dial. These values are detailed in Fig. 1.

The following hints and kinks for breadboard work may be useful for you. Figure 7 shows an easy method for mounting small, single, variable capacitors on a copper-clad baseboard.

When checking the frequency of an oscillator *always* find the *fundamental* with an absorption wavemeter. And remember that once in a while you could encounter an oscillator working gaily away on two frequencies at once! It's happened to me.

Oscillator squegging can be heard on almost any receiver tuned on or near the frequency. Tuning is broad because of super-regenerative action.

Watch out for loop tuning of components and ground leads. Granted, this is a nasty one. Can happen most easily when several components are going to ground from one tuned circuit and the same ground is not used for all leads. This does not apply to the dc filter sometimes used. This can be difficult but can be checked by using a tiny square .001 or .01 capacitor cemented onto a "coffee-stick," with about 1/8th inch leads protruding. Touch these leads from a suspected tie-point to ground.

Tune in the converter every once in a while with the gain of the receiver being used way down, so that gain differences are not swamped out by avc action. You may not need all the gain of this front end, but it's nice to have it available.

Results on Ten

This delayed the work here quite a bit, because I started hearing the sort of stuff I hadn't heard for years, and I stopped and listened to the band for some time.

The method of breadboard design has been stressed to help you work out the problems of a ten meter tuner, battery operated, and to get you on the air

. . . KICLL

Dave Brockman K6LJY/7
Apartment 301
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AN IC FACSIMILE RECEIVING CONVERTER

Back in August and September of 1971, *73* published a couple of articles on facsimile, one of my unrequited loves. I read the articles with great interest and, a few days later while on a routine visit to a local surplus dealer, I met my first FAX machine. It was an RD-92A/UX Facsimile Recorder, and I bought it. Now, all I had to do was get it home (it was kinda big), plug it into the station, and I was in the FAX business. Right? Wrong! I got it home all right, but there were still a few things I had to learn about FAX. One was where to get the special electrostatic recording paper the thing needed. Another was how to get some intelligence onto the paper from the funny sounding signals I could hear on my receiver. Well, I got the paper from Fitchburg CPI, Scranton, Pennsylvania, and I built the receiving converter myself.

Before I could build the converter, I had to figure out what it was supposed to do and how it was supposed to work. A study of the earlier articles revealed that most FAX machines prefer to digest an audio subcarrier that is amplitude modulated with the picture information and that the normal HF radio transmission mode was direct FM or FSK of the RF carrier by the picture information. I Found that the converter usually processed the audio as received by an SSB type receiver. The converter I built consists of a limiter (to remove amplitude noise and signal fading effects) followed by a low pass filter. The low pass filter, by virtue of its roll-off characteristic, converts the audio FM signal to an AM signal with a variable carrier frequency. The FAX machine is insensitive (over a range) to the frequency of the subcarrier input, only the amplitude – so the variable carrier frequency causes no trouble.

The normal deviation of RF FAX signals is 800 Hz and the receiver is usually tuned to put the recovered audio into one of two standard frequency ranges: 1500 to 2300 Hz or 2300 to 3100 Hz. The RD-92A has a bandpass input characteristic designed to pass the latter frequency range. Black is represented by 2300 Hz and white by 3100 Hz. In between is gray. Experiments with the machine and paper indicated that the black input level should be about two times the white input level to provide a fair gray scale for pictures (sent by FM) and sharp lines for maps (sent by FSK). The slope and cutoff characteristics of the converter's low pass filter were selected accordingly.

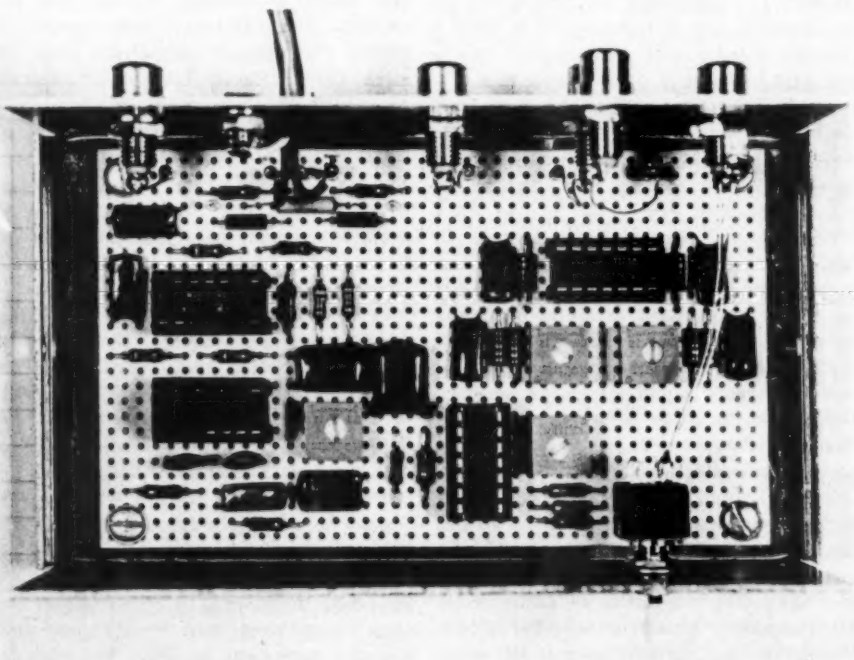
Construction Details

The converter was built on a piece of 0.1 in. grid perforated board (Micro-Vectorboard). All IC's used were DIP's and were mounted in sockets. The capacitors used, except the electrolytics, were low voltage polyester film types made by International Electronics Corporation (IEC). They were Series EM and are low in cost, small in size, and stable.The pots used were Beckman Series 72PM. These are 3/8 in. square, PC mounting, screwdriver adjust, single turn units that sell for about 70¢ each. Very nice! The converter board was mounted in one minibox and the power supply in another.

My receiver has a low level audio output for accessory gadgets so an input amplifier is included in the converter. It is an LM741C op amp connected as an ac coupled non-inverting amplifier with a gain of about one-hundred one. This gain is suitable for use with inputs up to 100 mV. If the input is expected to be larger, the gain should be reduced by increasing the value of R6. The output of the stage is capacitively coupled to a voltage divider and reduced by 50% to prevent overdriving the limiter input.

The limiter is a slightly compensated LM709C op amp operated in the open loop configuration. This means that the op amp output will be driven to saturation by very small input signals. The effect is to remove amplitude variations from the input signal and produce a constant amplitude, square edged output signal. The inverting input of the 709 is bypassed and returned to a pot to allow the limiter threshold to be set at precisely zero volts. This insures maximum sensitivity. The output of the limiter drives the low pass filter.

The low pass filter is a three pole active device using an LM747 dual op amp with both sections connected as voltage followers. The filter characteristic is nominally a Butterworth with a cutoff frequency of 2300 Hz. The first pole of the filter is formed by R3, R4, and C4. This section also



Inside view of the receiving converter. Toggle switch is for shifting BFO in the receiver.

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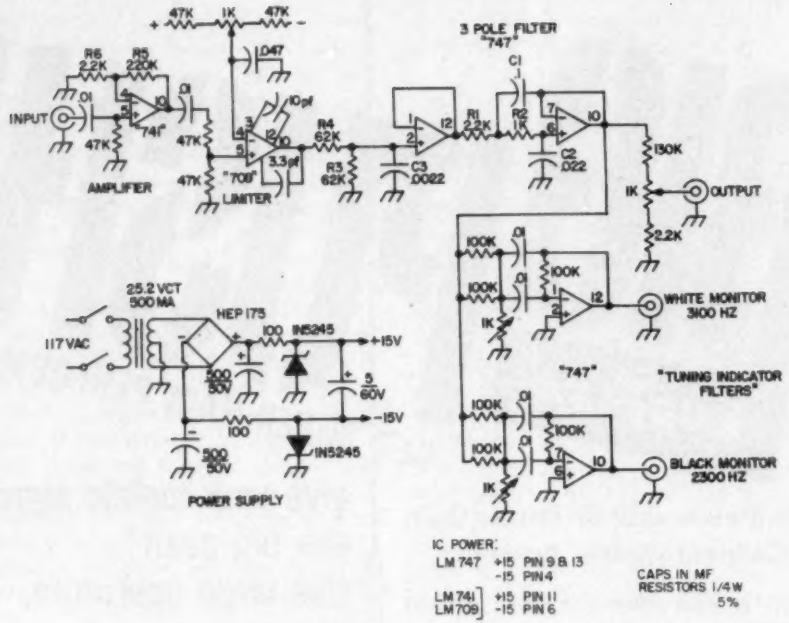

Fig. 1. Converter schematic.

provides a signal reduction of 50% to prevent overdriving the first voltage follower. The second voltage follower and C1, C2, R1, and R2 form the other two poles of the filter. More about active filters later.

Ordinary 5% composition resistors and 10% capacitors were used to build the low pass filter. This means that, if the component tolerances gang up, the deviation from the ideal filter characteristic could be quite great. Generally, this doesn't happen and – in any event – this application does not require a precise filter. The filter should be built and the response checked. The filter output at 3100 Hz should be about 53.5% of the output at 2300 Hz. The response for an ideal filter is listed in Table I. At frequencies below 2300 Hz, the filter output, ideally, will increase and finally level off at about 141% of the output at 2300 Hz. At frequencies above 3100 Hz, the filter output will decrease until it disappears into the noise level.

The output of the filter drives the FAX machine through an attenuator network with a pot. The range of the output adjustment is small because the RD-92A has a thirty step input attenuator and the pot need only cover one step. The output of the filter also drives the inputs of the tuning indicator filters. These are active two-pole band pass devices built with one LM747 dual op amp. Each filter has a bandwidth of about 300 Hz and the center frequency is tuned by a single pot. One filter is tuned to 2300 Hz (black) and the other to 3100 Hz (white) and their outputs would normally feed the horizontal and vertical inputs, respectively, of an oscilloscope. The filters have unity gain at their center frequencies and are driven from the low pass filter output to insure a pleasing scope pattern. If driven directly from the limiter output, the filters distort and the scope pattern has kinks in it. The scope gain controls can be used to compensate for the fact that the 3100 Hz filter output is lower than the 2300 Hz filter output.

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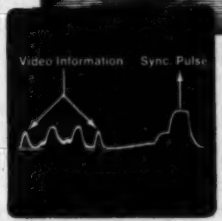

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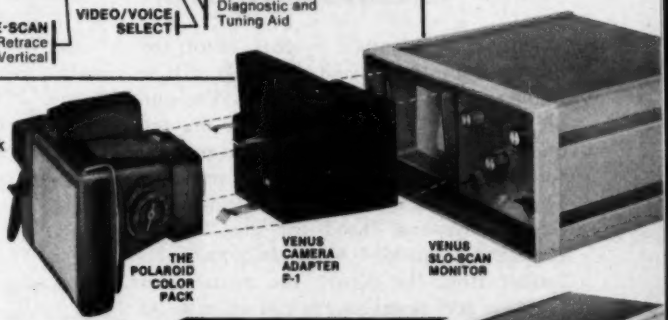

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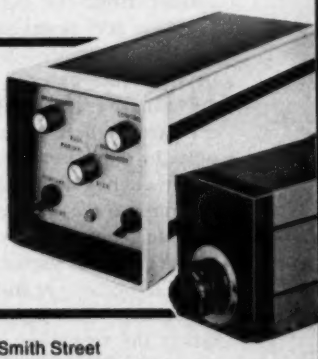

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supply. Plus and minus 15V was used mainly because I happened to have the diodes on hand. Other voltages, down to about plus and minus 10V, should work equally well. Regulated voltages are required because the limiter output (clipping levels) peak-to-peak voltage is determined mainly by the supply voltages.

Active Filters in General

The technique used to build the low pass filter used in the converter should find many uses in amateur equipment. It is called a Voltage Controlled Voltage Source (VCVS) synthesis and is so cheap to do that it is competitive with inductor-type filters (especially at audio frequencies). A VCVS is basically an amplifier. It provides a high input impedance, a low output impedance, and an output that is directly controlled by the input voltage. The voltage follower is an especially simple device that meets that meets these requirements. It has a gain of very nearly one (when made with a high gain op amp) so filters synthesized with it will have a gain of one (generally). A VCVS synthesis may be used to realize any type of poles-only high or low pass filter characteristic.

Filters are described by their cutoff frequency, roll off rate, and the shape of their frequency response characteristic. The cutoff frequency is often defined as the frequency where the filter response is reduced to 70.7% (-3 dB) of the pass band response. The roll off rate is the ultimate rate at which the filter response "heads for" zero beyond the cutoff frequency. As the frequency gets further from the cutoff, the actual filter response gets closer to the roll off rate. At one frequency decade (a ten to one ratio) beyond the cutoff, most filter response curves have reached the roll off rate. The roll off rate is determined by the number of poles in the filter and is equal to 20 decibels per frequency decade per pole. The shape of the filter frequency response can be almost anything, but three types have been found to be the most useful: Butterworth, Bessel, and Chebychev. A Butterworth filter has a maximally flat pass band response and makes the transition from the pass band to the roll off rate moderately fast. A Bessel filter provides linear phase response in the pass band at the expense of a rather slow transition from the pass band to the roll off rate. A Chebychev filter provides the quickest transition to the roll off rate, but it has a ripple in the pass band. Amplitude frequency response curves for a four-pole low pass filter of each type are shown in Fig. 2.

	Freq.	Butterworth	Bessel	Chebychev
	0	1.000	1.000	1.000
	.05	1.000	.999	1.005
	.1	1.000	.997	1.018
	.15	1.000	.993	1.039
	.2	1.000	.987	1.064
	.25	1.000	.980	1.089
	.3	1.000	.972	1.109
	.35	1.000	.961	1.118
	.4	1.000	.949	1.112
	.45	.999	.937	1.093
LIN	.5	.998	.922	1.064
	.55	.996	.906	1.035
	.6	.992	.889	1.011
	.65	.984	.870	1.000
	.7	.972	.850	1.007
	.75	.953	.829	1.035
	.8	.925	.807	1.080
	.85	.886	.783	1.117
	.9	.836	.759	1.081
	.95	.775	.733	.923
	1.0	.707	.707	.707
		dB	dB	dB
	1.0	-3	-3	-3
	1.2	-7.24	-4.5	-13.07
	1.5	-14.25	-7.42	-23.75
LOG	2.0	-24.10	-13.41	-35.64
	2.5	-31.84	-19.52	-44.17
	3.0	-38.17	-25.09	-50.91
	4.0	-48.17	-34.43	-61.29
	5.0	-55.92	-41.92	-69.22

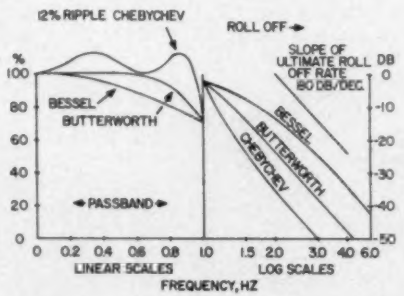
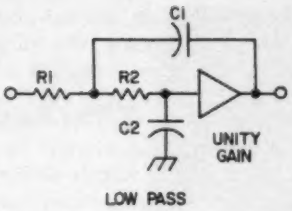


Fig. 2. 4 pole low pass response curves, 1 Hz cutoff.



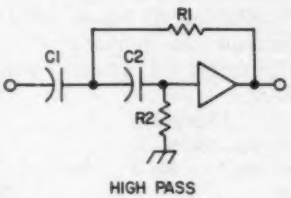
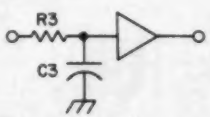


Fig. 3. Two pole sections.

Practically, the Butterworth response shape is the most generally useful so I shall describe its synthesis in detail.

Filters are made from two-pole (conjugate) sections, as shown in Fig. 3, connected in tandem. If the filter has an odd number of poles, a one-pole (simple) section, as shown in Fig. 4, is added in tandem to the rest. For a Butterworth filter, the cutoff frequency of each section is the same as the cutoff frequency of the entire filter. The component values for each section may be determined from the equations given in Fig. 5.



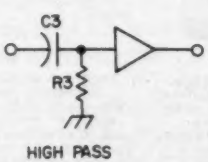


Fig. 4. One pole sections.

TABLE I

Frequency	Response Vout/V2300 Hz
2300 Hz	100%
2400	93.4%
2500	86.9%
2600	80.5%
2700	74.4%
2800	68.6%
2900	63.1%
3000	58.1%
3100	53.5%

Note that the equations for the two-pole section contain a coefficient, K1. This coefficient is determined for each two-pole section by the total number of poles in the filter. Values for K1 are listed in Table II for filters with up to seven poles. Note also that for a low pass two-pole section, the ratio of C1 to C2 must exceed a certain minimum value or the resistor equation yields negative values. The more accurate the resistors and capacitors used to build the filter, the more accurately the resulting filter will match the ideal characteristic. The equation for the

$$R_1 = \frac{K_1}{4\pi f_c C_2}\left[1 + \sqrt{1 - \frac{4C_2}{K_1{}^2 C_1}}\right]$$

$$R_2 = \frac{K_1}{4\pi f_c C_2}\left[1 - \sqrt{1 - \frac{4C_2}{K_1{}^2 C_1}}\right]$$

$$\frac{C_1}{C_2} \geqslant \frac{4}{K_1{}^2}$$

$$R_3 = \frac{1}{2\pi f_c C_3}$$

f_c is the cutoff frequency in hertz.

LOW PASS

$$R_1 = \frac{K_1}{2\pi f_c (C_1 + C_2)}$$

$$R_2 = \frac{C_1 + C_2}{2\pi f_c K_1 C_1 C_2}$$

$$R_3 = \frac{1}{2\pi f_c C_3}$$

HIGH PASS

Fig. 5. Component value equations.

$$\text{Response (Low pass)} \frac{V_{out}}{V_{in}} = \frac{1}{\sqrt{1 + \left(\frac{f_{in}}{f_c}\right)^{2N}}}$$

Where f_{in} = input frequency
f_c = cutoff frequency
N = number of poles

For high pass response, interchange f_c with f_{in} in bracketed term thus:

$$\left(\frac{f_c}{f_{in}}\right)^{2N}$$

Fig. 6. Ideal response.

amplitude response of an ideal Butterworth filter with any number of poles is given in Fig. 6. Very good filters may be built by using measured capcacitor values in the resistor equations and selecting the nearest one-percent resistor value for use in the filter. Acceptable filters can be made using ordinary 5% resistors and 10% capacitors.

As an example, let's design the filter used in the converter. The cutoff frequency is to be 2300 Hz and three pole are required. This means a one-pole section and a two-pole section are needed. First, the one-pole section: Choose the capacitor value to give a reasonable resistor value (less than a megohm): Choose C3 equal to 0.0022 microfarad. Compute: R3 equals 31454Ω. Use 30 KΩ. (Note: In the converter, to get a section gain of 50%, a voltage divider was incorporated into the one-pole section, and R3 is effectively in parallel with R4.) For the two pole section, refer to Table II to find the coefficient: K1 equals 1.000 (How nice!). Compute the minimum C1 to C2 ratio: Ratio equals 4:1. Choose C1 and C2

TABLE II

Filter Number of Poles	Two-Pole Section No. 1	No. 2	No. 3
1	x	x	x
2	1.4142	x	x
3	1.000	x	x
4	1.8478	0.7654	x
5	1.6180	0.6180	x
6	1.9319	1.4142	0.5176
7	1.8019	1.2470	0.4450

Odd number of poles have simple one pole section added.

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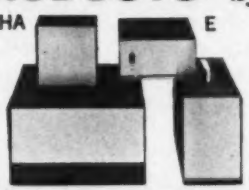

Model	Dimensions	Resale Net
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"HA"	5⅛ x 5½ x 4 (Blank Panel)	8.95
"K"	4¾ x 7⅛ x 11 W/Handle	13.50
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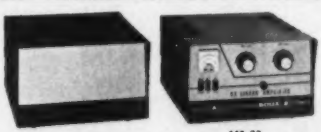

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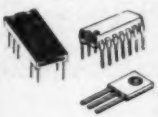

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accordingly (also, to keep the resistor values reasonable): C1 equals 0.1 μF. Compute R1 and R2: R1 equals 2118Ω and R2 equals 1028Ω. Use 2.2K and 1 KΩ. That's all there is to it! In most cases, the capacitor values (and ratio) can be juggled around to produce "nice" resistor value. In the case of low pass filters, where dc response is critical, the capacitor values should be selected to make the resistor values as small as possible to minimize the offset voltage created by the op amp bias current. Also, section inputs must be driven from low impedance sources, such as the output of an op amp, for best performance.

Tuneup and Conclusion

With a scope connected to the appropriate tuning indicator filter output, apply the proper input frequency (2300 or 3100 Hz) to the converter, and tune the filter for maximum deflection. Apply a small input signal and, with the scope connected to the limiter output, adjust the limiter sensitivity pot for the most symmetrical (50% duty cycle) squarewave limiter output. Finally, adjust the output level pot for the desired output level. For the RD-92A, this is done with a 3100 Hz signal input (white) and the output level is adjusted downward until the machine just stops writing (a black line). To operate, connect the converter to a receiver and tune in a FAX signal (usually USB) just as you would an RTTY signal: with the cross pattern on the tuning indicator scope. Then, wait for a phasing sequence, phase up your machine, push the "on" button, and go.

I have received 120 RPM 48 LPI maps from NPM, Hawaii (9440 and 13862.5 kHz), JMH, Tokyo (7305 and 13597 kHz), NSS, Washington, D.C. (8080 kHz), and many others. I have received pictures from AP on about 15989 kHz and UPI on about 15787 kHz (both LSB). Quality has been good. The maps come in twice because my machine runs at 60 RPM and 96 LIP. The pictures are sent at 60 RPM but not 96 LIP so they come out squashed. It's been fun. If your equipment doesn't use the 2300–3100 Hz range, redesign the low pass filter. It's easy. Now, if I could only find a Facsimile Transmitter . . .

. . .K6LJY/7

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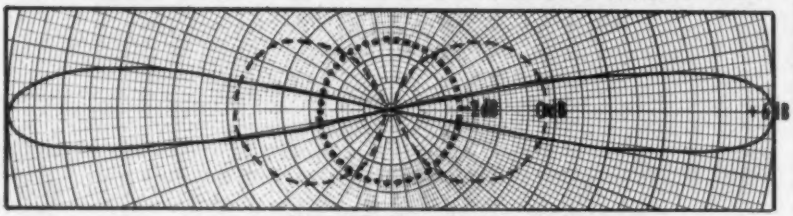
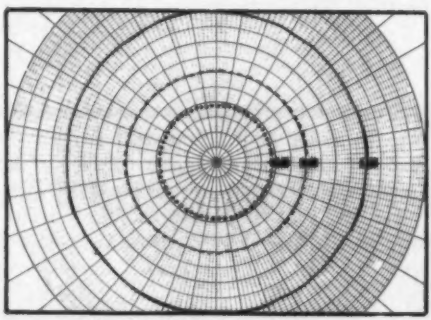
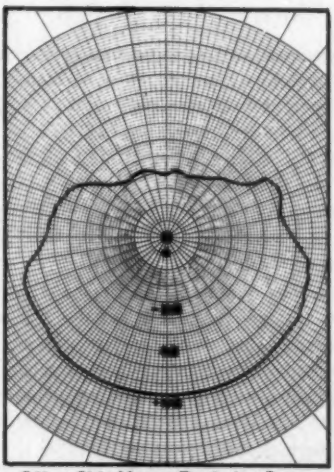


Vertical Radiation Pattern
TG5-S
Dipole
Isotropic



Horizontal Radiation Pattern
TG5-S
Dipole
Isotropic



Offset Side Mount Radiation Pattern
Reference: Dipole

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A SIMPLE TOUCHTONE PAD FOR AUTOPATCH

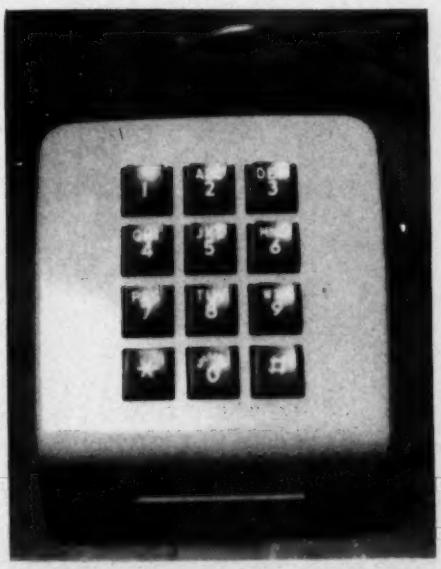
The Western Electric Model 1035C3 can be converted simply and inexpensively – it looks good too!

The Model 1035C3A Western Electric Touchtone Pad with case is becoming available to many amateurs. While recently there have been many complicated circuits for hooking up Touchtone pads, this pad needs almost no work to produce respectable tones. Further, it comes in a nice case and will immediately become XYL-approved. It's also small enough to be put into the glove compartment of a car and kept there for instant use.

The pad is designed for computer terminal use. A typical application is in a PBX where normal dial phones are used, but touchtone signals are needed. It is connected to the phone by a 14-conductor cable coming out the rear.

Conversion

This unit is easy to convert. First, remove the cover by carefully removing the two screws. The pad, a 35C3A, can be removed by loosening the two screws on each side of the pad and prying the bracket slightly apart. The cable to the phone is then removed and discarded.



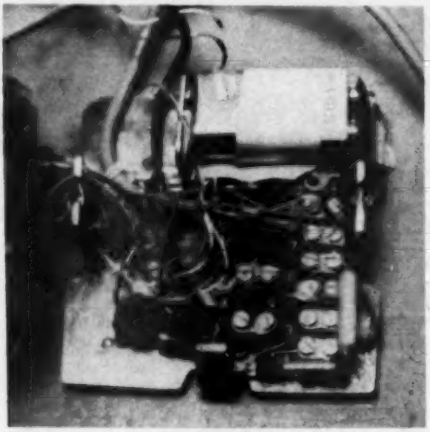
One will then see a large terminal board on the right side and a small printed circuit board with several resistors and a transistor in the upper corner. Remove the small printed circuit board and discard.

At this point one will have only the black terminal board left on the base. Remove all the wires from this board. Now hook up the external components as in Fig. 1. The pot is a small PC type with solder lugs soldered to its ends and a wire to its wiper. It is insulated with electrical tape and mounted to the lower left of the board.

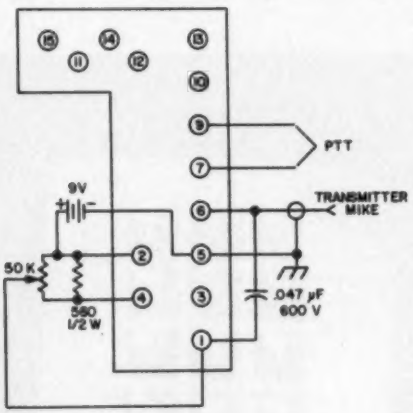
The wires from the pad are installed as in the Table. The pin numbers are those on the original strip. Tape over the top part of the board with two layers of electrical tape and use more tape to mount a 9V battery.

There is enough room just above the cord slot on the rear of the case to mount a mike jack. The plastic is easy to drill if one uses a knife point to make a starter hole and then drills carefully. Remember to clean your drill bits with alcohol before drilling to remove any oil left on the bits from drilling metal.

My connector hole was made with a chassis punch. So as not to deform the plastic, the punch was removed and rotated several times during the punching operation. With a little care a clean hole can be easily punched. After punching I washed the case with warm water and Ivory Snow to clean it.



Internal view of the converted unit.



Pin	Color of Wire
5	Orange/black and blue
7	Green/white
9	Violet
4	Green
11	Blue/white
12	Red/green and black
13	Orange
14	White
15	Red

Fig. 1. Hook-up of external components.

Connecting the Unit

A three foot shielded cord is used to connect the pad to the transceiver. The mike can then be plugged into the jack on the pad assembly. There are two terminals for the PTT leads, so it is immaterial which system your transceiver uses for keying. If one PTT lead is grounded you can connect terminal 5 to one of the PTT terminals. Thus by pushing any button your transmitter will automatically be keyed.

The pot must be set so that the output of the pad is about the same level as your mike. This can be done with a deviation meter or more crudely by someone listening to your direct signal.

Conclusion

This pad is simple to convert and allows the use of many autopatches. One call to the authorities during an emergency will repay in satisfaction its cost by a hundredfold. One warning should be mentioned. Do not use the autopatch for general use unless you are a member of the repeater group that runs the autopatch. This will elminate many hard feelings. Good luck and good patching.

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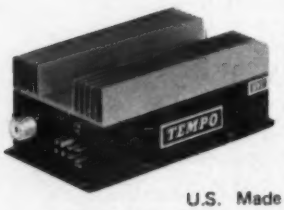

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Actually, the $1,000 is a conservative estimate – there were a few hidden costs mixed in with other expenses; some of the materials were used at the former QTH, and the money previously spent. Had I known the fuss and bother this project was going to be, I would have purchased a commercially-built 40-meter beam and a second tower. But that's getting ahead of things.

The XYL was making suggestions for building a new home – our "dream house" where all corners would be square and she would have a large, fully-equipped kitchen. I wasn't thinking so much about the kitchen as the ham shack, where there would be adequate space, plenty of heat (the old operating room in the garage was fine, but lacked a few conveniences), lots of electric outlets, and close to modern plumbing. We (she) designed a place exactly suited to our specifications and found the ideal building site – 5½ acres on top of a small hill in a rural setting about 40 minutes of driving time from work. We found a builder, signed a few papers, and construction was under way.

Since construction of a new place always takes time, even more time than you at first expect, there is plenty of time to plan an antenna system. The house is situated on top of the hill overlooking a small lake; the highest point for about a mile in any direction. The XYL concentrated on most of the details; I concentrated on the ham shack and antenna system. The contractor was most cooperative in matching everything to our specifications. The ham shack has an outside entrance; is just across the hall from the bathroom, and through one wall is the garage so that antenna wires can get outside conveniently. The walls are soundproofed so I can work contests or chase DX all night without keeping everybody up. In addition to some cellotex between the outside sheetrock, the walls are filled with fiberglass insulation. A 220V line comes in from the main electric service with breakers for the linear outlet (220) and the equipment outlets (110) as well as the rest of the lights and outlets. A separate 220V breaker is included to control a yard light to be installed on the tower. The yard light will be a "luminaire," one of those mercury-vapor fixtures. In case of RFI, I can cut it off.

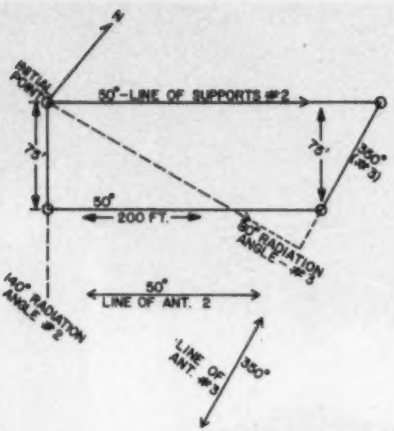


Fig. 1. The arrangement of antenna supports for the system.

Because of the design of the house, I could not locate the tower just outside the shack, so it had to go on the other side of the house. I was fortunate enough to meet a fellow who works for the power comany and who studies engineering at college – he wants to work for the local electric company in the high-tension department. He has had considerable experience up in the air and has all the equipment – safety belts, special shoes, and all this other stuff – that is needed. He agreed to construct the system for a small stipend. I can honestly say that without him and another fellow, WB6QQF, this whole thing would never have gotten off the ground.

While title to the land was being cleared, I had ample time to consult many antenna reference books to get exactly the system that would do the best job for me. I figured the beam would take care of 20, 15 and 10; I'd use the folded dipole on 75 (I hardly ever use that band except for a few local contacts and an occasional contest), but for 40, I'd do something special. I get quite active on WCARS (7255) during the summers in the daytime; in the winter I enjoy working 40 at night when the long skip comes in. Analyzing the signals that come in first from the east, I noticed that the fellows with the big antennas come in first, are loudest, and stay in the most. I wanted a big antenna, too.

The two most useful books I found are the ARRL Antenna Book and the B&E Radio Handbook. I wanted something that would work well NW-SE for WCARS and general daytime operation (nothing comes in from the Pacific except for an occasional ship at sea; there are just a handful of stations that come in from Nevada and Utah, with an occasional Idaho, Wyoming or Montana, so there is not much need for putting a signal where there are so few contacts); and something to go east for nighttime operation (we hear a few KH6's and a lot of foreign QRM at night, so no need to worry about much from that direction). The final system design was a combination of several good ideas seen in several sources – I have not seen this system described anywhere so maybe I can call it the "CPP Phased Array," or something like that.

The system is made up of three separate antennas on common supports. #1 is an ordinary dipole. #2 is the NW-SE array, consisting of two collinear pairs ½ wavelength apart and #3 is a two-element array for contacts east.

I decided to support this system on four telephone poles. The first step is to orient the antenna so the signal will go in the proper direction. With a large globe and a spherical protractor, I measured the angle for the main axis of the antennas. The #2 goes right down the San Joaquin Valley to Los Angeles; the other way should be good for contacting Alaska. Of course, the beam won't be so thin that I won't be able to do well in Washington and Idaho. The #3 I aimed on a great circle to come out about on the Virginia-North Carolina state line at the Atlantic Ocean, figuring the beam will be sufficiently broad to make almost any contact toward the east. The angles of the main

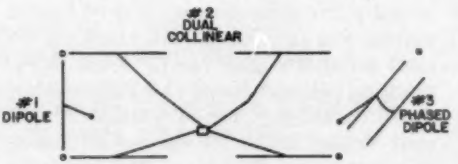
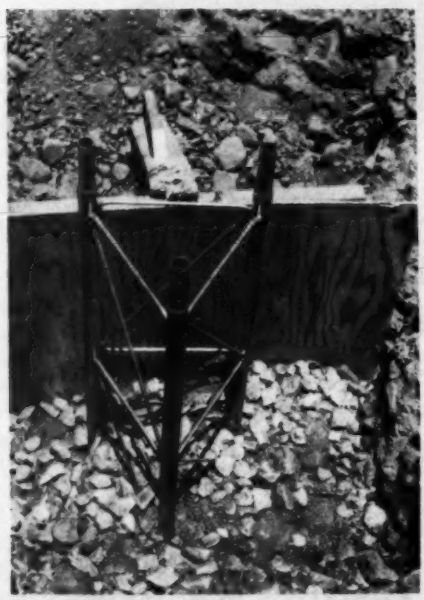


Fig. 2. The three antennas as they are strung between the supports.

lobes worked out to be about 80° and 140° using my rough equipment.

To get the azimuth of the supporting structures, subtract 90° (assuming you're planning a broadside radiation pattern), and determine where on the ground your supports will go. My measurements came to -10° or 350°, and 50°. Check a topographic map at your local library (at 75¢ these are getting too expensive to buy) for compass deviation from true north. Plot true north using a couple of stakes, adding or subtracting the compass correction. You might set these up at night, aiming toward the North Star – if you don't know where it is, ask any Boy Scout!

Assuming you have established the north line at your first point, use your transit (or a quite large protractor) and a long tape measure, preferably metal, to set up your system. Be sure to check everything several times – if you're measuring a rectangle, make sure adjacent sides are equal in length so your angles will be 90° (remember that high school geometry?).



Tower base set in place with gravel and rocks at bottom to facilitate drainage. The entire hole was then filled with concrete and base section made plumb before concrete set.

View of irrigation trenches before antenna construction started.

The supports on this installation are arranged in a trapezoid and came out something like Fig. 1.

A diagram of the elements between the supports looks like Fig. 2.

A study of each antenna by itself shows #1 to be a simple dipole. This was the one I used for many years at the old QTH. There is a 1:1 balun at the feed point fed by 75Ω coax.

The #2 antenna, designed for NW-SE, is the most complex. This consists of two collinear systems back-to-back; or maybe two back-to-back systems collinear. Each element is meticulously made precisely the same length – I chose 7225 kHz as the design frequency, since that is the center of the phone band. The phasing is accomplished in the feed lines – the lines feeding a collinear pair must be *exactly* the same length; the lines to the other pair must be *exactly* ½ wavelength different. The idea is to have each collinear pair in phase with each other, but the two pairs spaced ½ wavelength apart and phased 180°. I roughly figure there should be around 6 dB gain out of this configuration.

Notice that all elements are fed in parallel at the common point. I constructed the elements from 300Ω line (Belden #8235) and the feed line from the same stuff. Four 300Ω impedances connected in parallel should result in a 75Ω common point, so a 1:1 balun fed by 75Ω coax fills the bill.

Antenna #3 is an end-fire array. The elements are spaced 1/8 wavelength and phased 135°. These figures were obtained from a chart showing spacing, phasing, and the resultant patterns. The active elements

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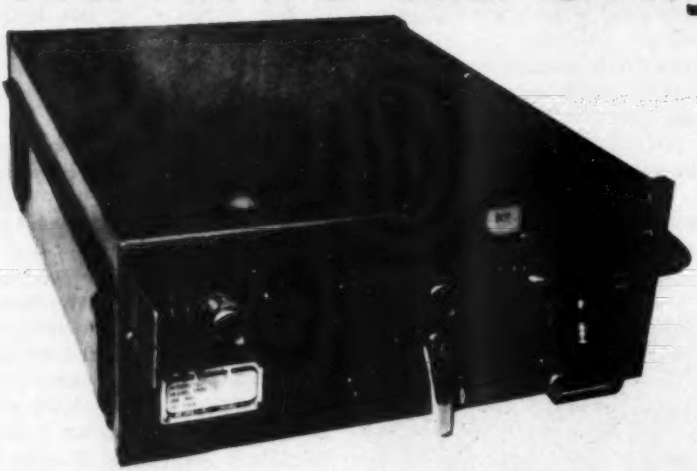

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Plastic pipe in trench containing feed coax and antenna switch wire.

are 3-wire dipoles with the center conductor twice the size of the outside conductors, resulting in a 600Ω feed point. Two 600Ω impedances in parallel results in a 300Ω system; a 4:1 balun nicely matches 75Ω coax. I used #14 wire for the center conductor and #20 wire for the outside conductors. For spacers, I used some scrap lumber cut 15 cm long, drilled for the wire, and boiled in paraffin. Commercially-made porcelain or ceramic spacers are available. A person looking at the chart could choose a variety of spacings and phasings to get the approximate pattern. This one does not give a sharp beam, but puts minimum sensitivity to the rear, which will eliminate the foreign QRM from the west that comes in over the Pacific. I wanted a fairly broad beam since this array is non-rotatable.

The design frequency for all antennas is 7225 kHz. To make this for any frequency, use the standard formulas

If you make your folded dipole out of 300Ω line, be sure to short the conductors together a distance from the feed point equal to the velocity factor of the line. The Belden line is 77% velocity, so 77% of a wavelength in free space, short the wires. This little fact comes from the Radio Handbook.

This system uses about 230 meters of 300Ω line, 190 meters of 75Ω coax, and about 125 meters of other wire. In addition, I used about 450 meters of ¼ inch (Std) nylon rope as spacers and supports.

Now, with all the necessary facts and figures, I was ready to start construction. The first thing is to get the supports. There is a telephone-pole place that cheerfully sold me four 12m high poles at $65 each. I should have stopped right there and put up another tower and a 40-meter beam – it would have been cheaper and easier. But I had my heart set on that figure eight pattern and the prestige of having a phased array (a beam is so pedestrian).

After the $260 plus tax for the poles, it was another $50 to have them delivered to the site. I wanted to get the power company to set them in while they did their own setting in the area, but I missed them. It cost another $100 to get a setting rig in there. After all this, we picked up some pole hardware and set in back guys and anchors. Each anchor is in about a yard of concrete. Two pulleys are at the top of each pole so that the antennas can be pulled into position from the ground.

The coax is buried from the shack to the antenna feed point. The contractor had a man with a backhoe doing some work, so he dug trenches for an irrigation system at the same time. We shared the irrigation trenches with the coax. To simplify any later requirements, I fed the coax through 1" (Std) plastic water pipe. Where the feed line connects to an antenna connection, the plastic pipe connects to a 90° PVC bend and a length of 1" (Std) conduit terminated at an electrical box. This material is instantly available at any electrical emporium. The plastic pipe came from an irrigation supply firm.

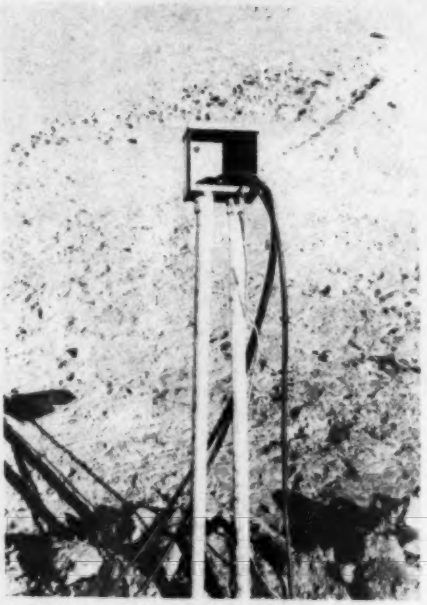
Only one feed line leaves the shack for the three antennas. A remote-control coax switch is installed at the first cutout. This 3-position switch operates on 27V dc supplied from the shack. A little power supply

and 3-position switch selects the antenna to be used, the others grounded. The switch is connected to the power supply by a run of 4-conductor cable going through the plastic pipe. Belden 8444 was used for this application. The switch is made by Dow Key; it took awhile between order and delivery, but they did send an apology for the "abysmal service."

After all the fuss on the phased array, we didn't think too much about the tower. This was installed in the standard way, placing the base section in a hole with some gravel in the bottom, then putting in the better part of a yard of concrete. Guy anchors were prepared according to specifications building up a little cage with reinforcing bars and using about a yard of concrete per anchor. One of the guys came down close to the front door, so a 3m high post was obtained from the telephone pole place, guys brought to this, and from here to an anchor. Nobody will knock his hat off on the guy wires! Each anchor is grounded with a ground rod. The top guy wire is broken up into non-resonant sections with egg insulators. The tower base is grounded with some #6 copper wire buried in a trench. Lightning arrestors are installed on the antenna coax at the bottom of the tower and at antenna feed points on the phased array.

The tower is a Rohn #25 with the usual accessories. I purchased this through my favorite supplier, but picked it up at the Rohn warehouse in Reno. This saves a bundle on shipping, and being an out-of-state sale, saved a few pennies on sales tax as well! My installer handled the antenna rigging in the regular way, except that he left the driven elements off the beam to facilitate attaching the antenna to the mast. These elements were installed last.

All this would have been wasted effort if the system didn't work. To test the tower, I checked into the County Hunters' net on 14336 to activate Calaveras County, and made about forty contacts in every call district using the mobile rig transceiver. Then we QSY'd to 15 meters and contacted Japan, who gave a 5–9+ report and said it sounded like I was using a full kilowatt (the mobile is a Swan 270). There was no significant activity on 10 meters. The swr



Housing for antenna coax switch.

was quite satisfactory except on 20 where the resonant frequency was a bit low; we will shorten the driven element almost 0.5 cm to compensate for this.

We temporarily connected the phased array and found the resonant frequency was a bit higher than expected, although on making a permanent connection we may eliminate some of the capacitance in the feed lines and lower the resonant point. There has not yet been sufficient time to evaluate the results, but the reports were good in the expected direction and the swr was no greater than 1.25:1 at the band edges. I have some plastic pipe left over from the irrigation job and am feeding the 300Ω line for 40-meter antenna #2 through this, attaching it to some fence posts. It will be about 1½ meters off the ground.

This is going to be a fine antenna system. Now that most of the frustrations are over, I'm glad I have it going. It is a matter of speculation as to what results would have been had I installed a second tower and beam. Maybe when I have some surplus cash I'll try it.

. . .WA6CPP

Lawrence Nickel K3VKC
13D Hogarth Circle
Cockeysville MD 21030

SPECIAL CONSIDERATIONS FOR DIGITAL DESIGN

Avert problems at the drawing board

Noise, crosstalk and spurious signals have always been a problem in electronics, and with the many new digital integrated circuits appearing on the market, it is imperative that everyone understand the practical aspects of digital design. There are special considerations to be aware of before the schematic is drawn up, and additional care is necessary in laying out a breadboard or printed circuit board.

Problems Generated by ICs

The ICs themselves produce numerous transients. Clock generators, comparators, multi's, lamp drivers, counters and decoders are all switching at various speeds and times producing pulses and spikes. Refer to Fig. 1. Suppose gate IC1 is supplying pulses to counter IC2. Gate IC3 supplies signals to IC4. Capacitor C represents the distributed coupling capacitances between printed circuit tracks (or wires) A and B. Assuming a pulse with a fast rise time is fed into gate IC3, IC3 will probably switch at a very fast rate (nanoseconds) and send the pulse along track B to IC4. Depending on the value of C, a certain portion of this pulse will be transferred to track A. This disturbance may cause IC2 to erroneously change state. This possibility is determined by the proximity of track A to track B, the noise immunity of IC2, the width and height of the pulse and the source impedance of IC1. Naturally it is important to separate tracks which may cuuse crosstalk problems. Since capacitances within IC2 will have to be charged (or discharged) before IC2 can change state, the

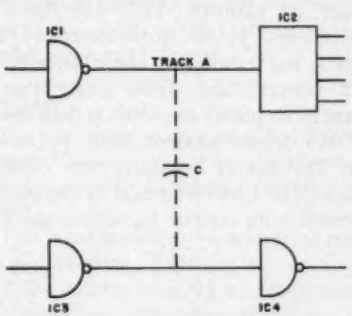


Fig. 1. Crosstalk interference.

question is largely one of energy (and thus the importance of the pulse height and width). If IC1 has a low output impedance the interfering signal may not be able to develop much voltage on track A. Generally speaking TTL (transistor-transistor logic) has a lower output Z than DTL (diode-transistor logic) or RTL (resistor-transistor logic). This

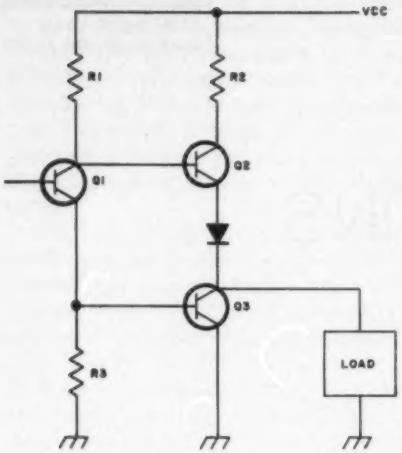


Fig. 2a. Typical TTL output stage.

is because of the active pull-up transistor in the output of the TTL. See Fig. 2a and 2b. Incidentally, it can now be easily seen why TLL is the higher speed logic. In Fig. 2b when Q1 cuts off it may take quite some time for R4 to charge a capacitive load to Vcc, whereas in Fig. 2a, Q3 cuts off and Q2 saturates, charging the load rapidly (naturally R2 is much smaller than R4).

Make no mistake, TTL does have its disadvantages. It is more expensive and usually is less immune to noise (since it can switch faster). And don't forget that it requires more power to switch at high speeds since the stored charges must be moved faster. The pull-up transistor also causes a problem. For a small portion of the switching period both output transistors are conducting. This demands extra current momentarily from the power supply (this could put transients on the supply line).

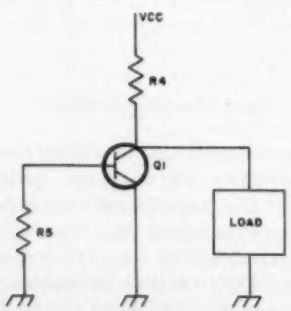


Fig. 2b. Typical DTL & RTL output stage.

Throughout this entire discussion it is becoming obvious that attention to practical details is mandatory. The power supply should be well regulated and also must have a low impedance at rf frequencies. Many electrolytic capacitors are nearly dead shorts at audio frequencies but have enough inductance at radio frequencies to render them completely ineffective. It is then necessary to bypass the supply line to ground with a .01 or .001 μF disc. At high switching speeds a printed circuit track several inches long may represent a substantial inductance. Lead lengths must be kept short. Tracks or wires carrying substantial currents should be made as heavy as is practical. The ground system is important. Do not string long grounds all around the pc board like a coil. Small disc capacitors may be needed at various spots on the board to bypass noise signals.

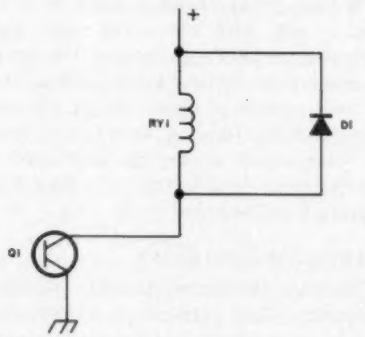


Fig. 3a. Diode noise suppression for dc circuit.

How Adjacent Circuits Affect Digital ICs

Often the most difficult problem to overcome is operating digital ICs in close proximity to electro-mechanical devices or interfacing with them. Relays, solenoids, switches and motors can play havoc with digital circuits. The author is familiar with a number of specific problems:

1. Relays and solenoids exhibit the characteristic inductive kick when they are de-energized. See Fig. 3a. If the coil runs on dc, a diode D1 will protect Q1 and suppress the

rf noise. Note however, that when Q1 cuts off, current will continue to flow from RY1 but now through D1. This means that RY1 will not drop out quite as fast as without the diode. It may be possible in some cases to achieve proper spike suppression and fast relay dropout by placing a resistor in series with D1 (try 1 KΩ as a starter, then work from there). In Fig. 3b, an ac relay is shunted with a non polarized capacitor (try from .1 to several microfarads). A bi-directional suppressor diode helps too.

2. Switching high current can cause rf fields and power line transients. It may be necessary to turn these currents on and off over a period of milliseconds or seconds rather than use the microsecond response of a relay or switch.

3. High voltage is a nemesis. A spark gap or even a corona discharge is a dandy rf source. Your counter, computer, etc. may be influenced by the electrostatic precipitator or neon sign in the next room. A generous application of corona dope may be a cure. Rf shielding can be a help.

4. Using switches and relays as inputs for digital ICs can pose special problems. Suppose a microswitch (or even a photocell driving a relay) is counting packages coming from a high speed production line. This switch drives a digital counter. Even if it is a slow counter it will probably still have a microsecond switching time. This is fine except that a switch or relay never really closes immediately when activated. It bounces quite a bit, sometimes for a millisecond or more. So for one input, a switch or relay may produce ten or 100 outputs or more. One standard solution for this problem is to drive the switch into an RS latch (flip-flop). See Fig. 4. This prevents the bounce from being transmitted to the counter. Another approach would be to use a photocell with a solid state relay (a transistor switch). That is, eliminate the use of a mechanical switch altogether. Of course the frequency response of any transducer that you use may have to be quite high since some digital ICs require a very fast input (quick rise time or fall time) pulse for reliable triggering.

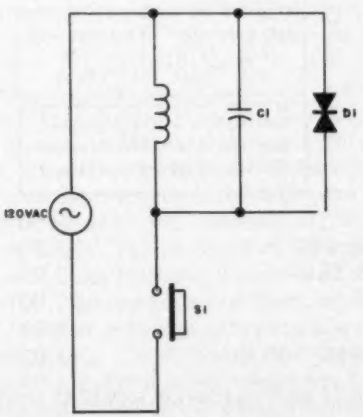


Fig. 3b. Suppression on an ac circuit.

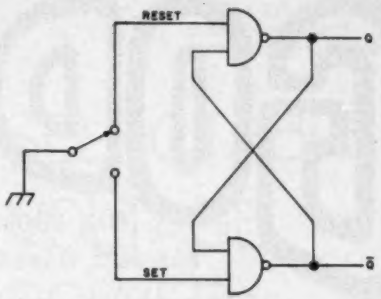


Fig. 4. RS latch; for output use either Q or $\overline{Q}$.

Summary

If your digital circuit does not operate as expected your diligence as a troubleshooter will be tested. However, consider these ideas:

1. A simple change in lead dress may be all that is needed.

2. Be careful in using an oscilloscope to find transients. The capacity of the scope probe to the circuit board may be all that is needed to pick up the interference. The noise may be on the power supply line, but you may pick it up no matter where you put the probe.

3. You may ultimately decide that in your particular application it would have been simpler to use relay switching instead of ICs (isn't that a revolting thought?).

. . .K3VKC

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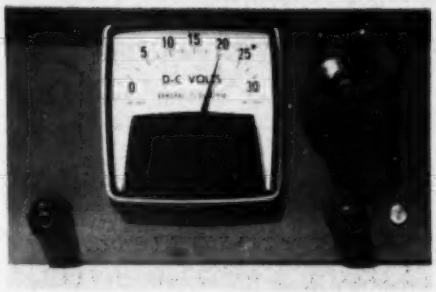

SELECTABLE VOLTAGE POWER SUPPLY

Sooner or later every experimenter reaches the point when the cost of buying batteries for his solid state projects exceeds the cost of building a line powered power supply. This project is intended to fit into the point in his experience where he has had some success building things and is ready for a project that will become a permanent part of his collection of test equipment.

Figure 1 shows a simple bridge rectifier power supply with a two transistor shunt regulator. The transformer and diodes supply the voltage which is regulated by the two transistor plus diodes circuit. The regulator performs the function of a simple zener or VR tube regulator. The regulator has a constant voltage drop across it, and any voltage in excess of that specific voltage drop will be shorted to ground through the two transistors. Q1 takes the majority of the load when it is holding the voltage down. The internal resistance of the diodes and the transformer allow this "shorting out" of the power supply. The operation of the regulator itself is quite simple. The diodes have a constant voltage drop across them and they are in series with the resistor across the power supply. Since the diode voltage is constant any change in the voltage across the power supply will appear directly across the resistor. Note that the resistor is also directly across the base-emitter junctions of the two transistors. The voltage across the resistor is the bias voltage for the transistors. As the power supply voltage increases, the bias voltage increases. With increase in the bias, the transistors, notably Q1, conduct more current. This increase in current tends to "short out" the power supply voltage to lower it to the regulation voltage. A decrease in output voltage decreases the conduction through Q1 and tends to increase the output voltage in response to the decrease. The diodes determine the regulating voltage. The output voltage will be the diode breakdown voltage plus the approximately 1.4 volt drop across the two forward biased transistor junctions. This points out the reason for all the diodes in addition to D1.

Switching in different zener diodes would be the obvious way to select voltages, but zener diodes are expensive and the inexpensive ones can vary by as much as a few volts of their marked value. Almost every experimenter has a handful of small glass signal or switching diodes that he got in a bargain package, and later found that he had no use for them. These diodes are added in series with D1, but in the forward biased direction. This takes advantage of the forward biased voltage drop of 0.2 volts for a germanium junction and 0.7 volts for a silicon junction. Note that the zener is in its reverse breakdown mode providing the lowest fixed regulation voltage while the other diodes

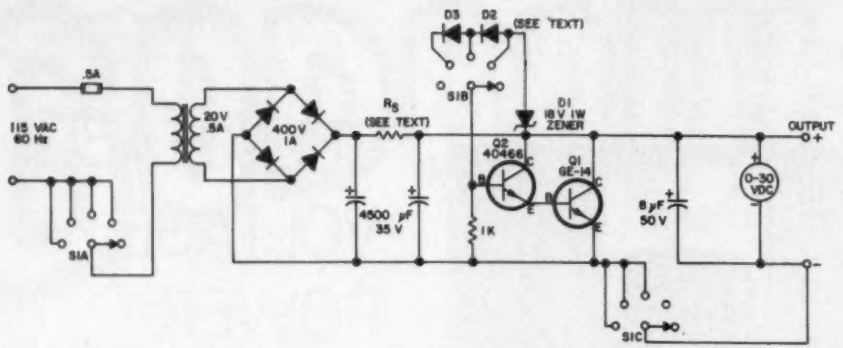

Fig. 1. Schematic diagram. F1 = 0.5 amp line fuse; T = 115 VAC primary, 20 VAC secondary at 0.5A; D1 = 18V 1W zener; D2,D3 = small diode combinations; D4–D7 = 400V 1A rectifier diodes; Rs = series current setting resistor; S1 = AC 3 pole, 5 position rotary switch; M = 0–30V voltmeter; Q1 = GE-14 transistor; Q2 = 40466 transistor.

provide additional switchable increments. Just use lots of diodes and a big switch.

Construction

The construction is non-critical and the parts can be assembled in almost any manner. The only critical component is Q1. This transistor dissipates the entire power that is "shorted out" in the regulation process. The power must be dissipated as heat, which requires a good heat sink. In this case the transistors were bolted to the largest piece of metal available; the chassis. Almost any silicon power transistor can be used for Q2, so long as it has about a 60 volt rating. Q1 must have about a 25 watt power rating, a 60 volt voltage rating, and handle about 4 amps. These ratings are conservative, of course, to allow for transient problems and endurance under high temperatures. The ratings of the transistor used are actually much greater, since the increase in cost was nominal. A one watt zener was used because it was available, but a few hundred milliwatts should be adequate. The small diodes can be selected by experiment to determine type and amount of them necessary to obtain the voltages desired.

Operation

Setting the power supply up for operation is just a matter of selecting voltages by trying different combinations of diodes and setting current by adjusting the series resistance for maximum current without overheating Q1. Q1 will normally run quite hot, particularly in the lower voltage ranges where the regulator works the hardest. If a higher voltage transformer is used, Q1 is too hot, or lower voltages are desired, a dropping resistor will be necessary. The resistor can be about 10–100Ω, depending upon the parts used. The parts used as shown in the schematic gave the following results:

Switch Position	1	2	3	4
Voltage	18V	20V	23V	25V
Current	500 Ma	400 Ma	300 Ma	100 Ma (no regulation)

The current readings were made for a one percent drop in output voltage as the load was increased. The ripple in the worst case was about one percent. One unusual feature is that the chassis is connected to the positive B+ lead. This is because the transistors were bolted to the chassis without the insulating mica spacer and the necessary silicon grease. The chassis really should be grounded, but I don't expect any troubles.

Conclusion

This power supply was built out of junk box components in one evening. The builder should use the schematic as a guide to use whatever parts he has available to experiment to build a power supply to obtain whatever voltages he desires. This project is not difficult and will make a very useful "first project" for the experimenter to gain experience as well as power for his future experiments and projects.

...WB6BIH

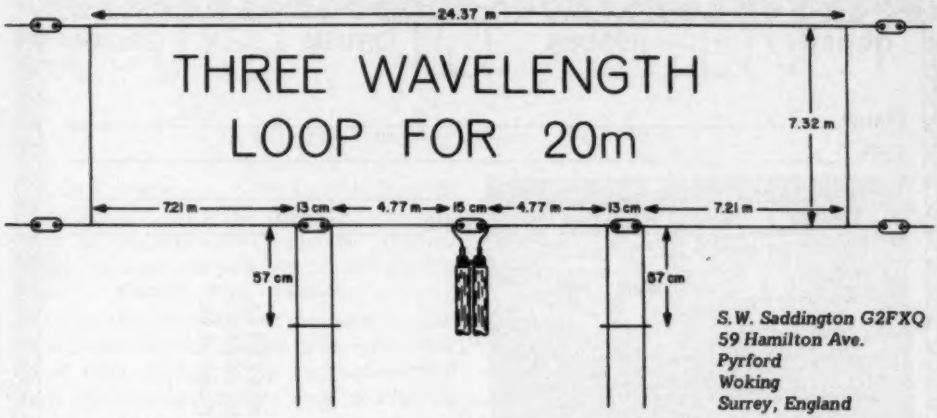

Fig. 1. Three wavelength loop antenna for 20 meters. All measurements are metric.

The three wavelength loop antenna is no substitute for a carefully constructed and well elevated cubical quad or three element beam, but it is simple to make, easy to adjust, and does provide a valuable measure of that all important low angle radiation. It also has a more or less all-round radiation pattern and therefore needs neither tower nor rotating gear.

The dimensions of the antenna in meters, as I erected it, are shown in Fig. 2. The two stubs, positioned approximately at voltage antinodes, are for tuning purposes, and should be adjusted equally for mid-band resonance. This is done in the normal way, with a grid dip oscillator at the feed point, before the λ/4 transformer and line are attached.

Figure 1 shows the shape of the antenna in its vertical plane, and its dimensions in terms of wavelength. By feeding it with a low impedance line at point "x," voltage maxima occur at points marked "A" and "B,' these two letters signifying opposite phase. There are thus, in effect, two 1½λ wires which are in phase, and stacked λ/3 apart. The impedance at point "x" is 130Ω a value which can be conveniently matched to a 75Ω line by a 100Ω λ/4 transformer. In my case this λ/4 transformer is made from two λ/4 lengths of 500Ω coaxial cable connected in series. My version of the antenna is also fitted with a λ/4 balun to reduce radiation from the 75Ω coaxial line, but this is a refinement which could be omitted.

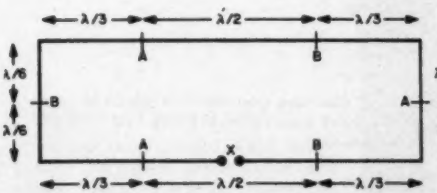

Fig. 2. The same antenna expressed in terms of wavelength as an aid in adapting the design to other bands.

Using the matching system described, the SWR achieved was 1/1.04 at mid-band and 1/1.08 at the band edges.

The theoretical gain of the antenna is about 4 dB (1 dB for the overall length of 1½λ plus 3 dB for the λ/3 stacking). This is not a particularly impressive figure, but you may judge for yourself whether or not the antenna is worth a trail. With a power input of 200 watts PEP, stations from all hemispheres were contacted with a minimum signal report of S5. Some stations worked were: HR2(S5), ZM3(S6), 5NZ(S7), 4 x 4(S7), ZLI(S7), EP2(S8), JA6(S8), CR6(S2), PY4(S2), 6Y5(S9+). All these contacts were during a six month period of random operation.

The height of the antenna used for the tests was 5 meters, and its position (near London) was roughly ENE/WSW. The horizontal radiation pattern is apparently the same as in the case of a single 1½λ wire.

. . .G2FXQ

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☐	146.94–94	☐
☐	147.00–00	☐
☐	147.99–39	☐
☐	147.96–36	☐
☐	147.93–33	☐
☐	147.90–30	☐
☐	147.87–27	☐
☐	147.84–24	☐
☐	147.81–21	☐
☐	147.78–18	☐
☐	147.75–15	☐
☐	147.72–12	☐
☐	147.69–09	☐
☐	147.66–06	☐
☐	147.63–03	☐
☐	147.60–00	☐

_____TOTAL _____

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A VISIT TO REGENCY

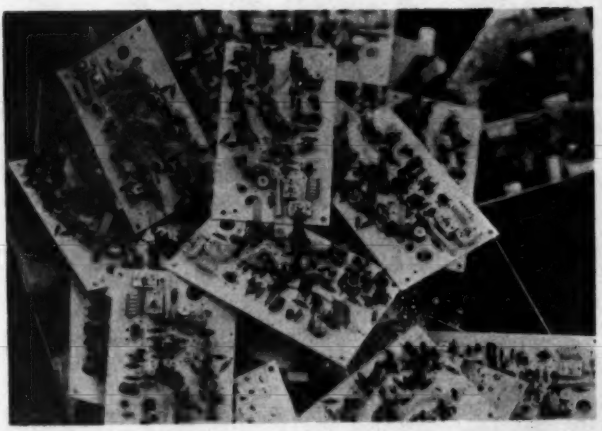
Picture Story by Wayne Green W2NSD/1

On the way out to the Dayton Hamvention Keith W7DXX and I stopped over for a day in Indianapolis to visit the Regency plant and see the new HR2B and HR220 rigs.

The ham end of their business is small compared to their scanner sales – but they have their production lines so well worked out that they can change from a ham rig to a scanner almost without a pause.

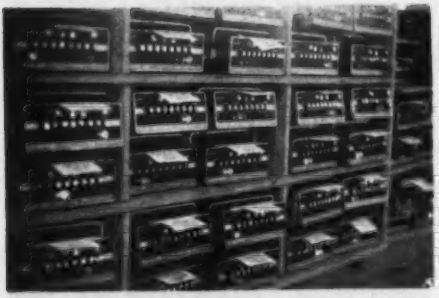
I took a few photographs to try and capture the idea of the pace at their plant.

There are hundreds of girls sitting in row after row of assembly lines. Their proficiency is such that a change from production of one unit to another takes only minutes.



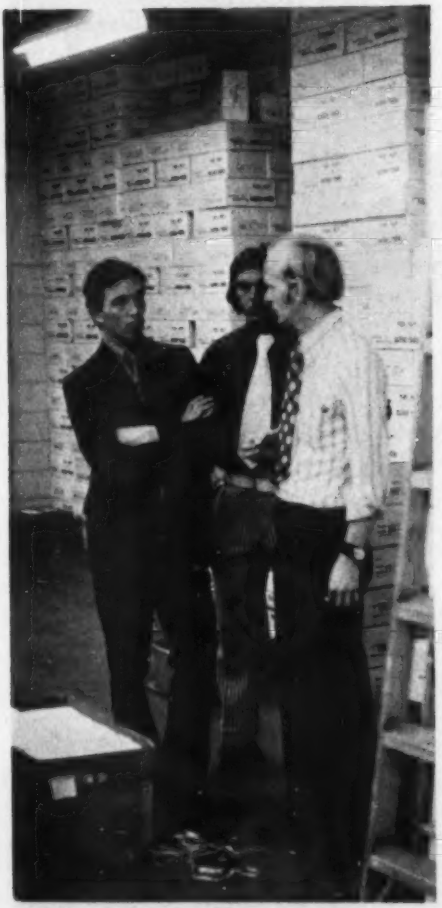
At the end of one line I found stacks of completed boards, ready to be mounted in the cases. Regency makes their own cases – they make virtually everything involved in their units.

Here are some of the AR-2 meter power amplifiers which have just been completed and are headed for the final checkout before being packaged.



There are hundreds upon hundreds of scanners set up in racks where they are run for several hours to make sure they are in perfect shape.

This is one day's returns for factory repair. The repair department puts great emphasis on a fast turnaround – they want the unit checked out, fixed and on its way back to the customer in one day if at all possible.



On the left is Keith – and on the right is a small part of one day's production of scanners, transceivers and amplifiers. Impressive.

This is one of the test positions for servicing. One of the main problems with scanning receivers is the use of the wrong or bum crystals! At least that makes the sets easy to fix.

We were impressed by the HR2B – very much like the HR2A except a bit more power output – and twelve channels transmit and receive – a nice new front panel design – and a high-low power switch where battery current is a factor. In this day of rising prices it was surprising to find that all these improvements have been added with no change in price – still a fantastic $229.

The HR-220 is remarkably like the 146 MHz gear and should help us to get some activity on that band. We are already working on a project to convert this fine rig into a repeater. It is ideally designed for this with its separate transmitter and receiver boards – its narrow band i-f filter – and the ease of getting at the boards and components. With a COR and a little work it looks as if we will be able to have repeaters for 222 MHz for $239!

. . .W2NSD/1

Larry W. Wilson
836 S. Lahoma
Norman, OK

A VERSATILE CODE PRACTICE OSCILLATOR

The neophyte intending to become an amateur radio operator, and all amateur operators intending to achieve a higher class of license, have had or will have use for a code practice oscillator, Ham journals, publications and handbooks have published scores of code practice oscillator circuits over the years. Many of them present certain disadvantages in their use. The CPO described in this article overcomes these disadvantages.

This code practice oscillator is battery powered; therefore, one is not tied to the wall by a line cord. Its current drain is less than that of a flashlight. The CPO has provisions for up to four keys and four sets of headphones. It is best to learn code with headphones since they tend to exclude external noises which disrupt one's concentration. Also, code is usually heard with headphones at the receiver, so one does not have to learn to use headphones later. Because of the portability of the CPO and the use of headphones, one can even have code practice sessions in a public library. Try that with a speaker type CPO! Up to four people can use this CPO at the same time. Any two people can communicate with each other; all four can practice to themselves; or a net can be established in which net procedure can be learned and practiced, or any of the four can provide copy practice to the other three. Early experience copying different fists is obtained.

East set of headphones has its own volume control allowing each person to set his volume level to his own preference. The person keying the CPO hears his own sending, making it easy to detect and correct mistakes and to hear his own fist, which helps to prevent developing a swing in his sending. Several of these units can be cascaded by setting all the mode switches to 'net' and using a patch cord between units. Several minutes of code instruction can be given to a group in this manner, and then by pulling the patch cords, several minutes of practice within small groups is possible. Two different code speeds can be given at the same time to two different groups by means of proper setting of the mode switch and appropriate patching.

This CPO utilizes digital integrated circuits which allows the builder to gain experience with IC's, etched circuits, and miniaturization and yet does not require much time in construction. Two MRTL (Motorola Resistor Transistor Logic) integrated circuits are used. They are inexpensive and are available from the larger electronic mail order houses. The MC 824P is a quad 2-input NOR gate. Each NOR gate consists of two common emitter amplifiers sharing

the same collector load resistor. Output is from the paralleled collectors. The NOR gate draws collector current if either input is made positive with respect to the emitters. The MC 889 is a hex inverter. Each inverter is merely a transistor with a collector load resistor and a base resistor. Output is from the collector. When the base input is made positive relative to the emitter, the collector draws current. Therefore, when the input of the inverter or either input of the NOR gate goes high (positive), the output goes low (towards emitter potential). Conversely, when the input to either device goes low the output goes high.

The NOR gates and four of the inverters are connected in such a way that one form of AND gate is obtained. In an AND gate, the output goes high only when both inputs are high. AND gates are necessary in the CPO. The NOR gates could not be used by themselves, because one would hear the oscillator tone when the key was up, and silence when the key was down. The other two inverters are cross-coupled with two capacitors and the bases biased with two resistors to form an astable multi-vibrator. Its output is rich with odd order harmonics. This sort of tone is much easier to listen to over a period of time than is a pure sine wave.

The circuit diagram is shown in Fig. 1. In the switch position shown, A and D are paired as are B and D. In the third position, A and D are paired as are B and C. In the fourth position, all are interconnected, forming a net. In the fifth position, each person practices alone without interfering with the others.

A convenient layout for the circuit, on an etched circuit board, is shown in Fig. 2. With this layout, no jumpers are needed and a single foil board is used. The board may easily be prepared in either of two ways. The first method uses an unsensitized circuit board which is placed behind the drawing of the board layout. A sharp sewing needle is used to pierce the page and indent the foil to show pad locations and bends in the "wires." Any of several resists (paint, tapes, dry transfers, etc.) are applied to the board. The board is then etched, drilled, cutout and the resist removed.

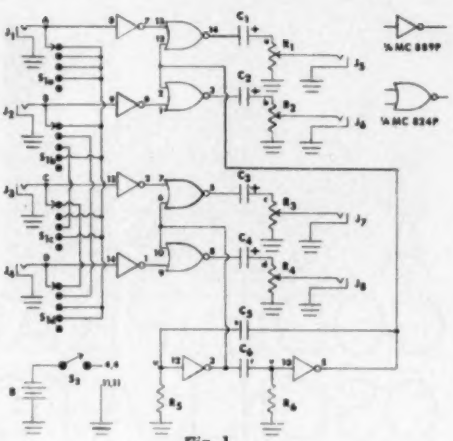


Fig. 1.

PARTS LIST

C1, C2, C3, C4 – 5 μF 6V dc electrolytic capacitor, Sprague TE1084
C5, C6 – 0.047 μF 200V dc capacitor, Sprague 192P 47392
R1, R2, R3, R4 – 500Ω potentiometer, Mallory U-2
R5, R6 – 22 KΩ ¼W 10% tolerance resistor
J1, J2, J3, J4 – Phone jack, Mallory LA-1
J5, J6, J7, J8
B – 2 flashlight cells (size D) in series in a Keystone No 176 cell holder
S1a, b, c, d – 4-pole 5-position nonOshorting rotary switch, Centralab PA-2011
S2 – SPST toggle switch, Arrow-Hart 20994LH
Miscellaneous – Motorola Integrated Circuit MC824P, Motorola Integrated Circuit MC889P, utility box 3 X 4 X 5 in., standard or semi-automatic keys, 2000Ω headphones

Another method of preparing the circuit board requires a sensitized circuit board. An actual size photolith negative is made of the drawing. Many professional photographers in the larger cities are able to do this. The negative is placed over the sensitized board and held flat against it with a piece of plate glass. The board is exposed to sunlight for three minutes and then "developed" in a bath of trichloroethylene. After it dries, it is etched in a stro solution of ferric chloride and water.

The integrated circuit pads are drilled with a #72 drill bit and the other pads with a #70 drill bit. The resist is then removed with steel wool and the board rinsed with water. The board pads must be tinned for effortless soldering. With your fingertip,

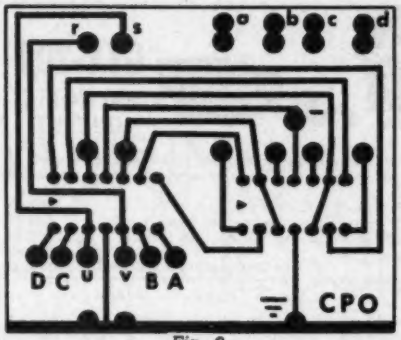


Fig. 2.

apply a thin film of soldering paste flux over all the pads. With a hot, low wattage soldering pencil having a tiny droplet of solder on the tip, QUICKLY tin all of the pads. Any lingering with a hot iron on the pads can loosen the foil from the board. Any pads that fill up can be redrilled. Resmear the board with a thin film of soldering flux and insert some of the components. These are installed opposite the foil side of the board. Put a tiny droplet of solder on the soldering pencil tip and apply this solder to the junction of the component lead and the board foil. One usually heats a joint with an iron and applies solder to the joint allowing it to flow, but in the case of circuit boards, the joint consists of tiny masses of metal which heat up instantly when the solder droplet is applied. When soldering IC's, and the use of a heatsink is impractical or impossible, get in with the solder and get out quick. Clip the component leads close to the board. Insert the remaining components and solder them. When you are finished, remove the flux with a cotton swab wetted with rubbing alcohol or trichloroethylene.

The resistors connect from pads u and v to the ground pads below them. The 0.047 μF capacitors are connected from pads a, b, c and d to their respective pads below them. The positive ends of the capacitors are connected to the pads a, b, c and d. The pad with the negative sign next to it is connected to the power switch and the pad with the ground symbol is grounded.

The integrated circuits are notched at one end. On the circuit board drawing, a small triangle denotes the end of the set of pads to which the notched end of the IC is to coincide. The MC 889P is mounted above pads A, B, v, u, C, and D. The MC 824P is mounted below the pads a, b, c, and d.

The board can be mounted to a utility box or chassis by drilling a hole or two in clear areas of the board and bolting it to the mounting surface through spacers in order to raise the board off the surface. Small wires are now connected between the board and the external components (jacks, pots, etc.). I built my unit in a 4 x 5 x 3 inch utility case without much crowding.

The construction of this CPO is an interesting project, in that not only will you develop your code proficiency; you will sample other techniques and skills you may not have tried before such as making etched circuit boards, rapid soldering, equipment layout and construction, and working with integrated circuits. It is not a unit that is built, used for a short time and discarded. It will be used again and again to keep your fist up, improve your code speed, and upgrade your license.

. . .Wilson

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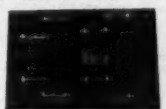

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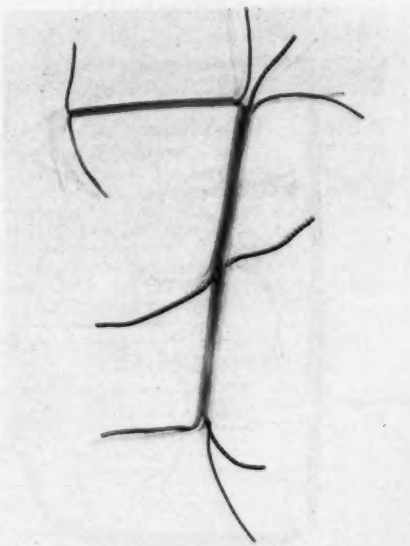
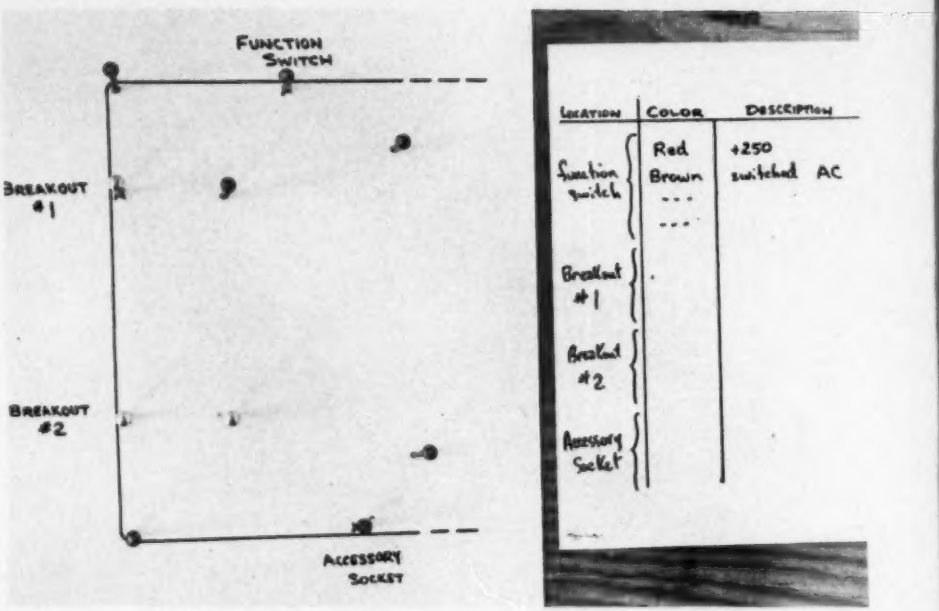
Generally the wiring harness is used for routing of filament, high voltage, bias, control and audio wiring from stage to stage under chassis. Often the harness is placed along the edge of the chassis, but on occasion may be placed in the center of the chassis. Placement parallel to the chassis edges is recommended for neatness. In order to keep the wires of the harness bound together neatly, general practice has been to lace the wires with wax-impregnated linen cord. It was mainly to circumvent this time-consuming chore that the following methods were developed.

The "Jig and Tape" Method

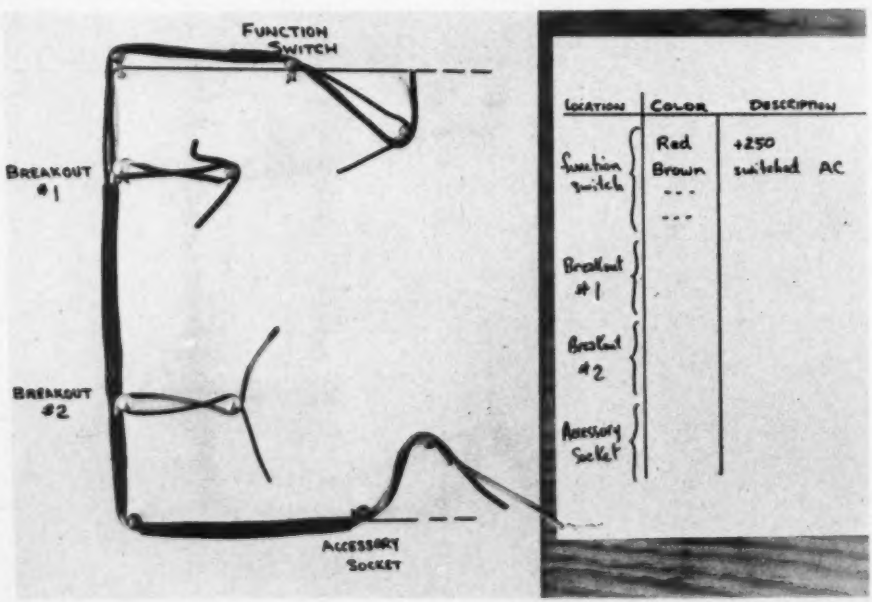
Needless to say, the constructor will have chosen a chassis and planned the part layout before proceeding to the wiring harness. After deciding on a route for the harness, it is traced on a sheet of paper stapled to a plywood base as shown. Nails are then driven into the plywood at each corner,



A wiring harness constructed by the sleeving method. Break the sleeving at corners and breakouts. If desired, stick the harness to the chassis with small dabs of epoxy cement.



The use of a jig for wiring harness assembly keeps the harness in shape and allows for easy taping. Nails are 7½ cm in length. As harness is assembled, wire coding is jotted down at right.



Assembled harness can be taped while still in place on the nails.

breakout and end termination; other nails are driven in for anchoring the wire ends. After placing the wires, tape the harness with light plastic electrical tape. The obvious way is to wind the tape about the wires; however for light harnesses, place the tape lengthwise and wrap around the wires using one or more strips as desired. Wind extra tape around the harness at ends and breakouts to give added strength. Keep track of the color coding as you proceed.

The "Sleeve" Method

This method involves running the wires through lengths of sleeving which have been cut to fit between discontinuities in the harness. Sleeving size may vary along the harness to fit the size of the wire bundle. This method is very quick and normally a jig is not needed unless the harness is long or if the sleeving is too flexible. I like to use the stiff fabric type of sleeving rather than the plastic type. Plastic tubing in various sizes is available in 25 ft lengths from such suppliers as Allied Radio Corporation.

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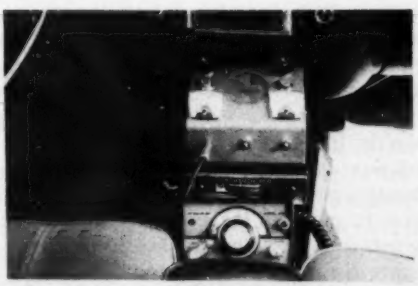
One of the first things the active mobiling ham does when he takes proud possession of a new car is to attempt to figure out how and where to mount the rig. Operating efficiency, mechanical and electrical factors are high on the list of considerations, second only to type-approval by the XYL. After enduring years of QRM from this source with previous mobile installations, using the customary under-dash location on the passenger side (with its attendant complaints of restricted legroom, bruised shins and torn nylons) use of this area was ruled out in my new car. This decision was supported by the fact that in this car, as in almost all new cars, the dash itself and the space beneath it has been sneakily phased out at the factory by inconsiderate designers, and has apparently gone the way of the buggy-whip socket and running boards.

The space in the center of the car over the driveshaft hump was too small for the conventional low-band transceiver. This left only the trunk area, and a method of trunk-mounting the rig and remote-controlling it was then worked out. Requirements from the driver's position included full frequency coverage over the entire phone subband of the operating frequency; on-off power switching; volume control; metering of plate current, modulation and rf output in transmit mode; metering of signal strength in receive mode; microphone input; speaker output; headphone output (more on this later); and as a final refinement, controlled illumination of the meters and VFO dial. No part of the equipment could extend into the passenger side of the car, serving the function of a noise-blanker (XYL type). On the rig itself, there were to be no major modifications or hole drilling.



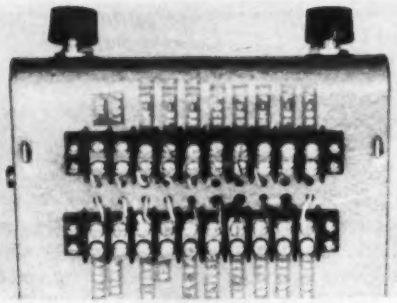
Backseat driver's view of the control unit, VFO and auxiliary rig.

Front Seat Mounting

I decided to use an external VFO, and to build a small control unit for the remaining functions. An armrest, fitting between the seats, with a shelf extending forward over the driveshaft tunnel, was obtained from the car dealer. Similar units, with or without shelves attached, are available inexpensively from many auto accessory stores, to fit either bucket or bench seats. The shelf can be shortened to clear four-on-the-floor, and usually will still accomodate the VFO and control unit in line. If space is extremely limited, the VFO and control unit can be stacked vertically. In my installation, with a steering-column-mounted gearshift, the VFO was bolted to the shelf, positioned with the tuning knob easily accessible when using the armrest. The control unit was also bolted to the shelf, forward of the VFO. The shelf is fastened with self-tapping sheet-metal screws to the driveshaft housing, for both rigidity and theft control. All wiring is run out of sight beneath the shelf and carpet, along the driveshaft housing, under the rear seat and into the trunk.

Frequency Control

The rig I use has an external VFO, with integral rf gain control, which connects to the transceiver by a short cable and octal plug. Most transceivers of recent vintage have provision for plugging in an external VFO. Those that do not can usually be adapted without too much difficulty to



Rear view of control unit.

accept an outboard unit, either factory made or homebrew, plugging into a rear-apron-mounted octal socket. Many excellent articles on construction of separate VFO's have appeared in recent ham publications.

An octal socket and plug, with shells for each, was obtained. After measuring the needed extension length from the existing VFO plug to the socket on the trunk-mounted transceiver, a 14' extension cable was made up. The circuit diagram of the VFO cable includes one 72Ω coaxial line for the frequency control lead. The velvet lined junk box contained only 52Ω RG-58 antenna line coax. I tried this and it worked perfectly. It has been said that lengthening the VFO lines would throw off the dial calibration, due to added capacity in the cable. Like the bumblebee, whose wings have been determined by engineers to be aerodynamically incapable of supporting him in flight, but who doesn't know this and flies anyway, the long cable was tried. No shift in dial calibration was noted. Such shift might occur in some types of VFO's – if so, it can probably be compensated for with the trimmer capacitors in the VFO circuitry. Four-conductor color-coded rotator cable was used for the remaining power leads in the extension cable. The lead supplying power to the VFO dial light was omitted.

Function Controls

The unit was built into a sloping-front meter case, Bud CMA-1930A, measuring 5 x 8 x 5". Two barrier-type terminal strips are rear-mounted on the case, and all interior wiring brought out to the strips. From the strips, all control lines to the trunk-mounted equipment are attached via spade-type terminals.

Audio

A three-inch-diameter speaker, with the cone protected by aluminum window-screen covered with grille cloth was mounted under the center opening in the meter case. In many cars, it is virtually impossible to reach the speaker wiring on the broadcast band receiver without major surgery. In other cars, with accessible speakers on the BC radios, the speaker in the control unit could be eliminated, and a DPDT switch used to feed the audio (after going through the volume control in the control unit) from either the ham rig or the BC receiver to the car speaker. In this installation, another type of rig with a very poor speaker is also used occasionally and a DPDT switch (shown at the center of the control unit) is used to switch the audio of either unit to the speaker. The speaker is wired through a closed-circuit phone jack to a volume control (20Ω potentiometer) in an L-pad configuration, and from there to the terminal strip. From the strip, a two-conductor shielded line goes to the trunk, terminating in a shielded plug connecting to the phone jack on the transceiver. Inserting the plug silences the internal speaker in the rig. The receiver volume control is left about three-quarters open, and the volume controlled by the pot in the control unit.

The headphone jack is used on extended trips with my wife. For some reason which I cannot understand, she fails to appreciate the beauty of the mellow tones contained in an SSB pileup on the lower end of twenty meters. By putting her behind the wheel, I am able to sit in the co-pilot's position, plugging in the phones which silence the speaker in the control unit. She thus drives in comparative peace and quiet, while I work the rig. If you employ this system, a word of caution – the use of only the right-side headphone is recommended. This permits you to monitor the driver's carefree comments such as, "Why are those two little red lights flashing on the instrument panel?"

Rf gain is controlled by the pot in the control head. In practice, this control is infrequently used in mobile operation. If

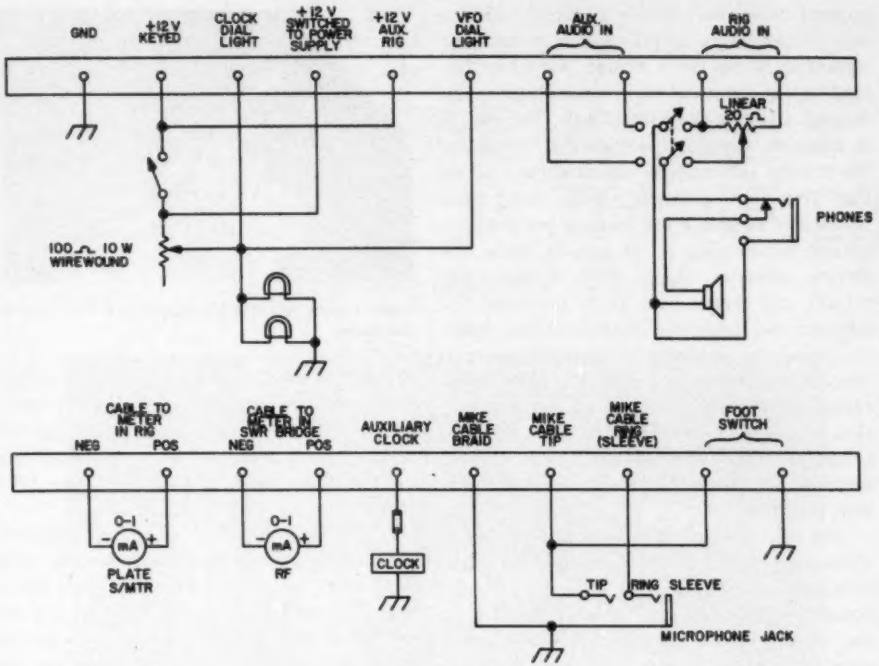


Fig. 1. Circuit diagram.

your remote VFO does not contain this control, leave the gain control on the rig wide open and forget it.

Power switching is controlled by the SPST switch on the right front side of the panel. Use of a colume-control-mounted switch, if available, would eliminate the need for a separate switch. The keyed hot line from the ignition switch feeds into the terminal strip, through the switch and back to the terminal strip to a line connecting to the fuse at the trunk-mounted power supply.

Instrument light control, very useful with night driving, is done through a wire-wound 100Ω 10W variable resistor, taking power from the output side of the power switch. The use of a wire-wound resistor is mandatory – carbon resistors arc and burn out. A line brought out from the instrument light socket to the terminal strip connects to the dial light in the VFO, permitting control of lamp brilliance on both meters and the VFO dial.

Meters are miniature 1 mA dc meters. Each meter connects directly to the terminal strip and from there by way of color-coded two-conductor cables, to the trunk compartment. At the transceiver, a DPDT switch is mounted on a small bracket, fastened with bolts and washers through one of the vent slots at the top of the transceiver. The switch is wired to permit the lines feeding the plate current meter in the rig to be switched either to the internal meter in the rig, or to the line connecting to the remote meter in the control unit. A small polarized in-line plug and jack is used, permitting easy disconnection if the transceiver is to be removed from the car for fixed-station use or servicing. With switch in the "internal" position, the meter in the rig is used for tuneup. The "remote" position permits monitoring plate current and modulation when transmitting and signal strength in receive mode. The remote meter scale was not recalibrated, and readings are inter-

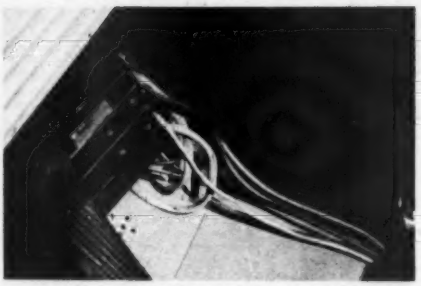
polated from the degree of needle deflection. A miniature DPDT switch is similarly mounted in the SWR bridge, with a polarized in-line plug and jack connecting to the second meter in the control unit. The switch is similarly used in the "internal" position for tuneup and antenna adjustments, and in the "remote" position (with the bridge "fwd/rev" switch in the forward position) to permit monitoring of rf output from the driving position. Most SWR bridges use a 100 μA meter, and it is necessary to advance the sensitivity control on the bridge to obtain a readable deflection on the control-unit meter. As only a relative indication of rf being radiated is needed, calibration is unnecessary – the sensitivity control is set to give full-scale deflection of the control-unit meter when the rig is in the tune position.

The microphone jack is connected by a three-wire shielded cable to the terminal strip, and then by similar cable to a three-conductor shielded plug which connects to the mike jack on the rig. A ceramic mike with PTT switch is normally used. The two control leads from the control unit mike jack also connect to two additional terminals on the terminal strip and then to a foot switch. When used with a miniature military-type microphone which clips to either eyeglass frames or a lightweight headband, the foot switch permits no-hands control of the transmit-receive function.

Transceiver Mounting

The U-bracket formerly used for under-dash mounting of the transceiver was mounted inside the trunk, on the underside

Trunk mounting. Transceiver meter switch on bracket over meter, SWR bridge meter switch on the right side.



Power supply mounted in wheel well. Note ventilation holes.

of the rear deck, just forward of the hinged trunk lid. Large self-tapping sheet metal screws hold the bracket in place. To the left of the rig, a small homebrew bracket was similarly mounted to support the SWR bridge.

The power supply is also trunkmounted. It is desirable to get the supply away from the engine compartment, which gets up to well over 400°F on a hot day. My present car has a well on the left side for a second spare tire, and this space was used for the power supply. The picture shows extra holes drilled in the well for ventilation, both in front and behind the supply. Use heavy gage 4 or 6 stranded color-coded wire, available from electrical supply houses, for direct connection to both positive and negative battery terminals rather than using the car frame for the negative lead. This supplies full voltage to the power supply. If trunk mounting in your car is impractical, conventional engine-compartment mounting may be used and an extension cord with proper mating plug and socket may be used to reach the transceiver in the trunk.

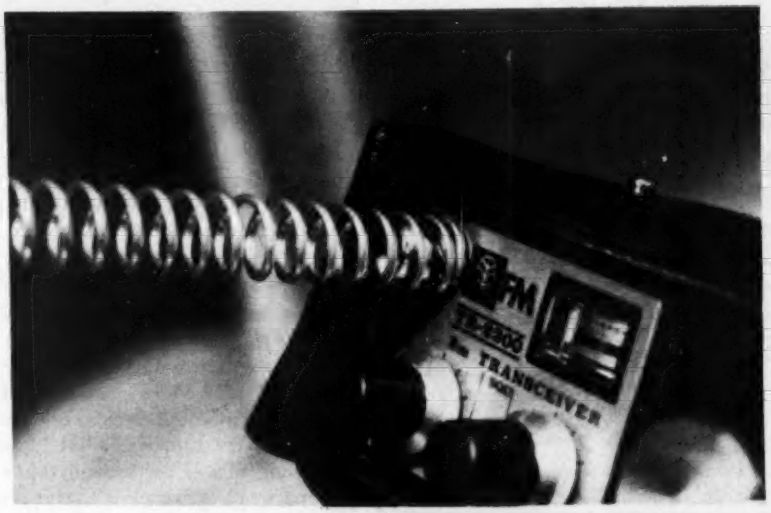
That's about it. This rig has now travelled well over a quarter of a million miles, during which time I have had lots of fun, many fine QSO's, made a few emergency contacts, qualified for WAS, WAC, and made at last count contacts with 157 foreign countries. Since making up the control unit, I have enjoyed more efficient and convenient use of my transceiver. A similar unit, modified to fit your own car and rig, will give you many miles of carefree hamming. See you on the road!

...WA1GNX

Frank J. Derfler Jr. K9KIC
2333 Park Ave.
Riverside IL 60546

TWO UNBREAKABLE ANTENNAS FOR THE TR-22

. . . or, put a little spring in your mini-Drake



The spring fits snugly over the end of the standard TR-22 antenna. It can be removed in a second for use of the regular antenna.

The antenna on the Drake TR-22 seems to be breakage prone if subject to hard use. This is because it is a nice telescoping type which hides out of the way when not in use. It doesn't flex a bit, and any sharp blow in the extended position means trouble. A stubby antenna would be just the thing to help the situation, but the commercial stubbies must be modified to fit. Here are two antenna ideas that provide quick change capability with the normal TR-22 antenna, no modifications, easy storage, and very low cost.

A single thin black wire strung up the shoulder strap makes a dandy unbreakable invisible antenna. The wire can be woven in and out of the various buckles and rings of the strap and taped where needed. A large jaw alligator clip at the bottom attaches to the top of the regular collapsed antenna. The length of wire plus clip should equal the length of the regular antenna when extended. This antenna should only used in the over-the-shoulder position for maximum signal radiation. When not in use it should not be clipped to the case as it will tend to detune the normal antenna. Experiments with different lengths of wire in an attempt to compensate for the antenna being so close to the body had no consistent results.

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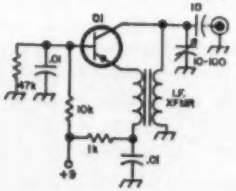

This beat frequency oscillator may be added to existing receivers with a minimum of difficulty. The BFO frequency is determined by the i-f transformer which provides feedback from collector to emitter. Transistor Q1 should be a SK3008, GE-9 or HEP-2.

A large clip fits over the end of the TR-22 antenna and a thin wire is woven and taped up the strap.

A non-breakable stubby antenna was made from a hardware store spring. A common display in hardware stores is "Select a Spring" from the company of the same name in Jersey City, New Jersey. Their number 60 spring looks like #16 wire and the turns are spaced 2 turns to the cm. It fits snugly over the top of the TR-22 antenna. Best of all, it sells for around thirty cents. The one small drawback is that it resonates at 220 MHz, but a 15.5 cm piece of wire on top of the spring got it to resonate on two meters. For some unknown reason, Murphy didn't strike, and this bright plated spring took solder easily. If you find a different length spring you can easily use a grid dip meter and a field strength meter to get it on frequency. This antenna can be readily carried in the microphone pouch when the regular antenna is in use.

While both of these antennas are compromises and are not quite as efficient as the built in unit, they will withstand rough use much better. The strap antenna does the best job, but the reception difference with either antenna is noticeable only on the marginal signals. The TR-22 is a beautiful and versatile rig. Now you have made it more so.

. . .K9KIC

LEADING ZERO SUPPRESSION FOR DIGITAL DISPLAYS

T. R. Jackson W1DMU
P.O. Box #1
Corinth VT 05039

A simple circuit is described which suppresses leading zeros in displays using cold cathode decimal indicators.

Leading zeros in a Nixie type display serve no useful purpose, unless it is considered useful to proclaim the instrument owner's multi-digit affluence. Indeed, a display such as 00539 is harder to read than just 539. Since it is a simple matter to expunge the superfluous zeros it seems a pity that it is not done more frequently in amateur-built equipment.

A circuit which will suppress leading zeros at well under $1 per digit so equipped is shown in Fig. 1. There are no cumulative problems in cascading these suppressors, so the circuit can be applied to as many or as few digits as the builder desires. With the addition of the SPST switch and resistor shown, the choice of displaying or blanking the leading zeros can be made from the front panel; the single switch will control the blanking on all decades.

The circuit will be described in some detail, to assist the potential user in adapting it to his own special requirements. The values of voltage and current given are rough approximations only; a more careful consideration of values and tolerances will be deferred to the section on "Circuit Details." Referring to Fig. 1, when the display driver has decoded a zero, "K0" (cathode #0) will be grounded, for this is what it takes to select a numeral in the display tube. All current through R1 is shunted to ground, and cannot turn Q1 on. For this description, an "on" transistor is one which has base current flowing so that it can conduct easily from collector to emitter, while the collector of an "off" transistor looks like an open circuit. When Q1 is off, the 500 μA supplied by R3 has no place to go other than the base of Q2, so Q2 turns on. When Q2 is on, the Nixie tube anode cannot be at more than 100V above ground because the 100V zener diode Z1 is then effectively connected from anode to ground; by the laws of Zenerism enough current will be drawn by Z1 through R_A to clamp the tube anode at 100V. 100V is not enough to maintain the glow discharge in the tube which promptly does just what we want: it goes off.

If any number other than zero is decoded, K0 will be at approximately 50V because of R1-R2 which acts as a voltage divider for the 145V at the tube anode, and 50 μA will pass through R2 turning Q1 on. Q1 then shorts Q2's base drive to ground, turning Q2 off. With Z1 thus disconnected from ground, the anode voltage is free to rise and the tube resumes normal operation. After the tube is lit, the steady voltage on Q2's collector will be the tube anode voltage (145V) minus the zener voltage (100V), or about 45V, but it may have to rise to some 70V peak at first to ignite the tube.

Whenever any tube is lit, the Q2 of that stage is off; about 50 μA is then supplied via R4 to the base of Q1 *in the next stage.* Since base current to Q1, from whatever source, ensures that the associated tube will be lit, the blanking is thus disabled after the first non-zero stage. This effect ripples all the way down the chain of digits, so that all tubes after the first lit one are always lit

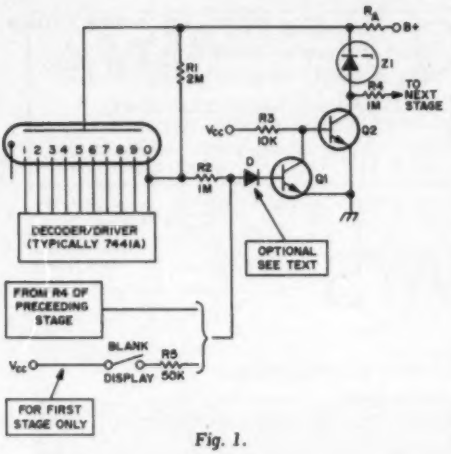

Fig. 1.

irrespective of zeros. In the special case of the first stage there is of course no preceding stage; if desired the switch and resistor shown can be used to provide the option of disabling the blanking.

When decimal points are provided an option can be included to automatically disable the zero blanking on digits after the active point. There are many variations of decimal point circuitry possible, and it is necessary to know just how the points are controlled before disablement circuitry can be designed. For the case where the points are selected by a simple grounding switch (or NPN transistor), Figs. 2 and 3 show typical arrangements. As Figs. 2 and 3 merely show modifications to the circuit of Fig. 1, unlabeled or missing parts and values are the same as in the basic circuit.

Figure 3 also shows one method of blanking the *entire* display, without regard to zeros, points, etc. This facility is particularly useful in counters which do not have storage latches, and in which it is desired to blank the whole display while counting. If the zener diode and high voltage transistor are to be included for zero blanking anyway, using them for total blanking also may prove less expensive than the usual method of turning off the B+ supply. +5V on the blanking bus will turn off the whole display.

Circuit Details

Whether or not the diode (D_{opt}) shown will be required depends on the type and quality of switches in the indicator driver. If the voltage at K0 is greater than about 0.6V when the zero is selected, then in the absence of D_{opt} some base current will go to Q1. If *enough* base current flows, the tube will not blank; how much is "enough" depends on the gain of Q1 and Q2. With a mechanical switch or saturated transistor there is no need to consider the use of any diodes at D_{opt}.

If the standard TTL Nixie decoder-driver is used, the 7441A, the formal specification gives the "on" voltage as 2.5V maximum, at (the abnormally high current of) 7 mA, and this would demand 3 or even 4 silicon diodes in series for D_{opt}. A look at the standard Texas Instruments schematic for the prototype 7441A shows 2 collector-emitter paths and a diode all in series between the selected cathode and ground. From this one would expect at least 0.8V even at low currents. However, it seems that not all manufacturers use the same internal circuitry for their 7441A's. The version made by National

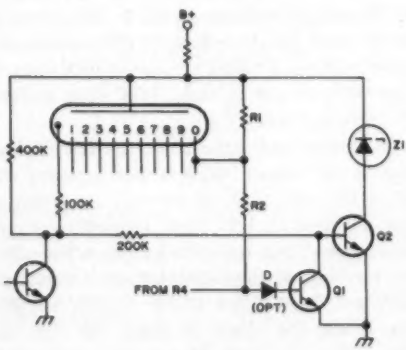

Fig. 2.

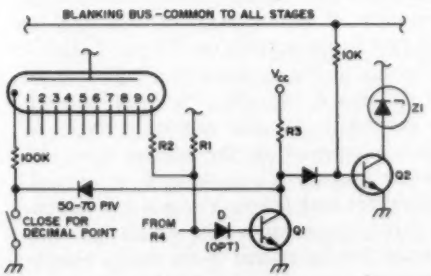

Fig. 3.

Semiconductor, for example, has just 3 saturated transistors in series between the selected cathode tube and ground (as an irrelevant aside, this particular version also decodes inputs greater than decimal "9" in an unusual manner that should be helpful to digital clock builders). I have recently tested a large batch of National 7441A's and found that most had an "on" voltage of 0.4V at 2.5 mA; only one was as high as 0.5V. With these particular IC's no diodes are required at D_{opt} for 2.5 mA service and this fact has been confirmed by practical use tests.[1]

The sum of the zener voltage (at about 50 μA) of Z1, plus V_{CES} of Q2 must be greater than the ignition voltage (usually 160V) of the tube. On the other hand, the zener voltage by itself (at whatever current R_A supplies) must not be greater than the tube's extinction voltage (usually 115V). If closely graded zeners are available it may be possible to use a Q2 with a relatively low V_{CES}, say 50V. However, with 10% tolerance types, a nominal 100V zener is ordinarily best.[2] With such a diode, the zener voltage would be between 90 and 110V, and a V_{CES} of 70V minimum is required for Q2. The Motorola MPS-HO5 at 36¢ will do, as will most of the 2N3858A's (at 30¢) that I have tested.

Q2 is either cutoff or saturated, and so dissipates only a few mW. When the stage is blanked, however, the zener dissipation is quite high. It is desirable to make the B+ as high as conveniently possible, as this calls for a large R_A which in turn reduces the power loading on the zener. As typical examples, both calculated for the worst-case when the zener voltage is 110V, if the B+ is 270V, and R_A is 50K, the zener dissipation will be 353 mW but if the B+ is only 180V, and R_A is appropriately reduced to 14K, the zener load will increase to 550 mW. Of course, as the power loading on the zener is decreased by increasing the B+, the dissipation in R_A increases, so there are *some* limits!

The rest of the components are non-critical. For example, R1 can be almost anything from 250K to 5 MΩ as long as R2 (more or less) equals ½R1. The limiting lower values for these resistors are set by the consideration that current shunted to ground through R1 is stolen from the numeral zero; the upper limits are set by the requirement that enough base current must flow to saturate Q1. With R2 at 2 MΩ only 75 μA is stolen from the zero, and Q1 needs a saturated β, or H_{FE}, of only 10 (at 500 μA collector current). Any one of thousands of different NPN transistors will do for Q1, as it has to stand off only V_{CC} (usually 5V); it is a rare transistor that will fail to meet the specification that collector-emitter saturation voltage should be less than ½V when driven with 50μA of base current.

It could be argued that the Q2 collectors should be protected with a zener to ground, and this would no doubt be admirable if such diodes were free. In my limited experience, however, the transistors used have proved able to operate with the limited reverse breakdown required, without damage to themselves. In the case of the last stage, it would be prudent to include R4 and attach its free end to ground; this should draw enough current through Z1 to force it into its zener region where it can protect Q2.

In conclusion, I should point out that the same circuit will work just as well "backwards," by connecting each R4 to the preceding stage, rather than the following one; in this configuration it would suppress *trailing* zeros. With further modification it could suppress *both* leading *and* trailing zeros, but I have not thought this worthwhile, especially as the trailing zeros do have some significance. I would also say that I feel quite well rewarded for the minor effort that was needed to add these circuits to several of my instruments. A display definitely appears friendlier and more intelligent when it no longer apes the mindless, and all too common, computer printout format of "XXXXXA11-Spaces-Must-Be-Filled-Regardless000000000."

...W1DMU

[1] Selected 7441A's, tested for "on" voltage less than 0.5V at 2.5 mA were available from the author at $2.00 each in ceramic DIP at the time of writing, and they may still be. When enquiring, please enclose an SASE. One "D_{opt}" may suffice for the more modern 74141, as of a batch recently tested, only one measured $>$ 1.25V @ 2.5 mA.

[2] 100V 10%, 1W zener diodes suitable for this use may be had at 4 per $1 ppd., from M. Weinschenker, Box 353, Irwin PA 15642.

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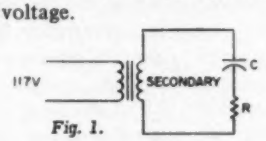

Fig. 1.

Now that you have the X_C, you can easily compute the capacitance. Remember that the formula is $X_C=\frac{1}{2\pi fC}$. The 2π is equal to 6.2832, the f is 60, and the X_C has been computed. Transposing the formula, we have $C=\frac{1}{2\pi f X_C}$. Remember that C is in Farads, so it will be very small.

You may find that the voltage drop across the capacitor is either too large or too small, If this is the problem, use either a larger or smaller resistor instead of the 1 MΩ.

...WB2VDX■

Dave Ingram K4TWJ
Rt. 11 Box 499
Eastwood Village #50 No.
Birmingham AL 35210

AUTOMATIC TOUCHTONE DIALER

Have you ever noticed those "funky" little telephones you put a pre-punched card in, hit a button and smiff, crunch, kapoof, it dials a number and spits the card back at you?

Like to have one in the car for use on the local repeater? It's easy enough if you have a loose cassette recorder or car tape player. Make up a patch cord with the proper plugs so you can feed the touchtone's output to the tape recorder's input. Now, find some old cassettes and rewind them to the beginning and, after setting the input level properly, "record dial" a number on the cassette so when rewound to the beginning and played back, the result is the tones opening the autopatch, dialing the desired number and after a few seconds (so you can stop the tape) the tones to clear the patch. Now parallel the cassette recorder's output with your mike and mark the unit's output pot for the audio level to match your voice, and all you need do is slap in the cassette and hit the button – the tape will do the rest. The circuit of Fig. 1 can be used to match the tape recorder output (Low Z) to the mike input (High Z).

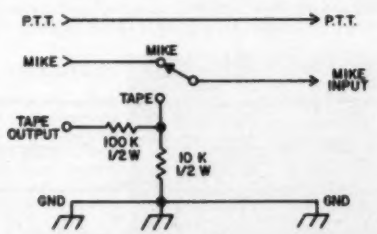

Fig. 1. Circuit for matching tape recorder output to mike input.

A small group of these cassettes (shortest length possible) with a couple of numbers on each and soon you've got all your numbers ready on automation.

If you have a tape deck in the car you're really set. Just install a jack so the mike plugs into and normals through the tape deck (Fig. 1). Now all that's necessary is to record the "phone numbers" on the auto tapes. Some auto-stereo enthusiasts have these recorders and will be glad to record the tones for you. Also, try 8 track tape dealers – often they will let you use their recorders for a nominal sum – tape duplicating companies will also record the tones for a small sum. The length of 8 track tapes is often long – 15 to 30 minutes. However, most cartridges can be opened by removing the screw in the middle, under the label; then carefully pull off a pile of this tape, leaving very little on the hub. Splice back together and route as usual, around the guides, etc. and close the cartridge back. Now record your "phone number" on the home brew short reel.

Although quite a novelty, I'm sure you'll find the auto-dialer very handy and it also relieves the necessity of carrying a pad.

The circuit of Fig. 1, which matches an 8Ω output to 50K (approximately) mike input is designed for use with a tape recorder at moderately low volume for average mike level, so very little fluctuation of values are needed.

. . .K4TWJ

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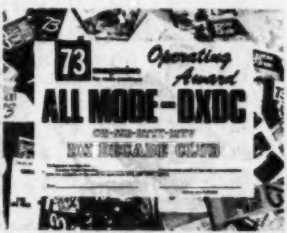

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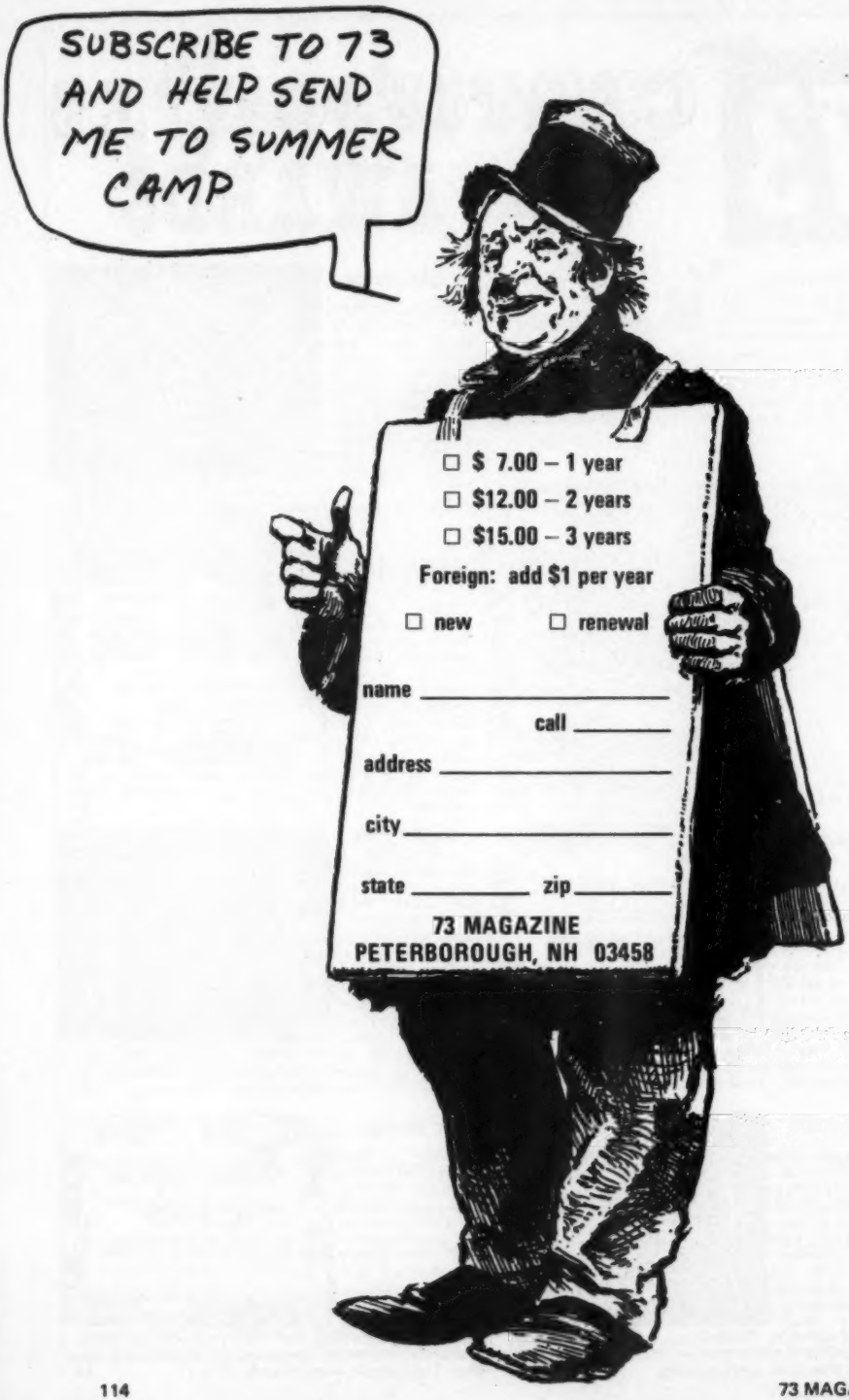
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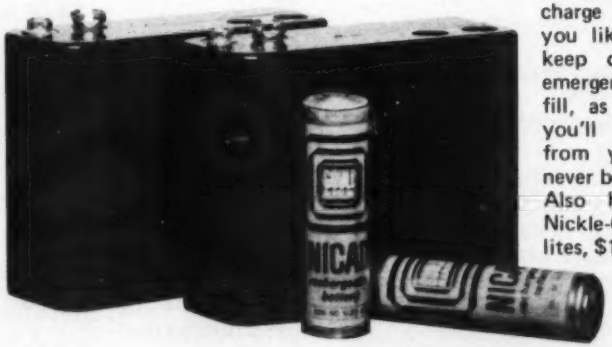

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NEWCOMER AND YOUTH TRAINING IN THE DARC

Alfred Müller, DL1FL,
Distriktsvorsitzender Schleswig-Holstein

Translated by HB9AJU

It is only in the eighth place in the rules constituting the DARC that we find "Preparation of interested persons for the radio amateur's examination." Nevertheless it is this training of the non-licensed members of the DARC which is the most obvious contribution of the club after the DL-QTC magazine and the QSL bureau. It is also a task which is carried out on an honorary basis. The fact that it is honorary is also instrumental in impressing on newcomers the image of brotherhood amongst radio amateurs.

As there are very few amateurs capable of complete self-preparation for the radio amateur's examination, it can be assumed that a large percentage of the approximately 1,200 new radio amateurs per year – a figure which represnts an annual increase of some 8% – have received their Morse, technical and operational training through the DARC.

The various German governments between the two world wars were not exactly well-disposed towards the idea of amateur radio. The reasons for this are to be found on the one hand in the principle of communications monopoly (which survived the old imperial telegraph laws) and, on the other hand, in the fear of revolutionary conspiracies.

From 1924 onwards every person in the Germany of that time who wished to listen to a tube receiver required an "audion experimental license." This license was only issued to members of recognized radio clubs. The result of this was that in 1925, when this absurd experimental license was finally abolished, such radio clubs counted some 50,000 members. Only these clubs were then granted club licenses for experimental transmissions. Later, re-issue of licenses was almost completely abolished. As a step toward interesting more enthusiasts in short-wave, Rolf Formis of the Oberdeutscher Funkverband in Stuttgart on his own initiative started issuing so-called DE numbers to SWLs in 1925. He also provided preprinted DE-QSL cards in order to secure reception reports from the whole of Europe for the Stuttgart amateur radio transmitter KY-4.

When, shortly afterwards, a new national amateur radio organization was founded – the DASD (Deutscher Sende- und Empfangsdienst) – these DE numbers were accepted more or less as the prerequisite for the subsequently introduced private transmitting license. Shortly after 1933, when the Nazi regime issued official private transmitting licenses to DASD pirates "of good conduct"

of frequency measuring equipment based on tube oscillators, as enterprising individuals might have had the idea of coupling it to a long antenna and using it for downtown CW operation! Even today when anyone even if he is not a member of the DARC – can take the radio amateur's examination, the German Bundespost prefers applicants previously to have passed a radio club examination and be in possession of a DE number, as this gives the postal authorities a good (because the regime could find no other suitably qualified persons, hi!) DE numbers were issued only after passing a prescribed examination. The licensing authority of the time, the Deutsche Reichspost, limited the number of transmitting licenses to 500 (later increased to some 850) because it considered this number to be the maximum which they could monitor. Membership of the DASD was anyway an absolute prerequisite if a "radio friend" (to quote the delightful term used) wished to obtain a license. As a sort of pre-selection for the radio amateur's examination, would-be candidates had to pass a DE test which comprised approximately two-thirds of the knowledge required for the full transmitting license. They were then required to send in SWL log sheets almost weekly. To give you an example of what this meant, I myself was finally admitted to the radio amateur's examination in 1935 only after two years of intensive SWL activity. Use was made of the logs to evaluate propagation conditions, and I believe that the collation of their contents resulted in some extremely interesting information and very useful propagation predictions. At that time there were, of course, no ionospheric sounding stations.

For the pre-war DE examintion – as for its present day successor – the Morse test was set at 40 letters per minute (eight words per minute), to this should be added an examination of the applicant's technical knowledge and operating ability. He also had to be in possession of an operational short-wave receiver for at least two amateur bands as well as frequency measuring equipment. For this latter requirement an absorption wave meter was considered adequate. It was considered too dangerous to give blanket approval to all DASD members for the use impression of the applicant's capabilities before he takes the official examination (which, incidentally, he can attempt a maximum of three times only). Another point is that the DARC's QSL bureau will only forward DE cards (which must contain three separate reports), but not SWL cards, from non-DE listeners. However, a certain amount of unrest had arisen recently because the Bundespost examination for the VHF transmitting license does not require knowledge of the Morse code, although this is a requirement for the DE exam.

From an initial number of some 160 in 1925, DE stations had reached almost 2,000 in 1933, 6,000 in 1945 and are now around 17,500. The DARC's Youth Committee finds it regrettable that the number of *active* DEs is less than 10% of all DARC members, but this is due to the fact that DEs usually qualify for their transmitting license after a relatively short time and then have other interests than a purely listening activity.

Training up to the transmitting examination level in the local DARC clubs (the so-called Ortsverband) requires approximately 160 to 200 hours plus additional homework. Depending on whether one manages one or two evenings of instruction a week, total training time can be between three quarters of a year to a year and a half. Four hours learning in a week permits the trainee to remember more than four hours spread over a fortnight. However, more than four hours a week does not, in our experience, bring any improvement. An exception is that it is beneficial to spend a quarter of an hour a day on CW. The DE examinatfon can usually be taken with success after about two-thirds of the total training time.

Radio amateur instructors are often disappointed by the fact that seldom more than half and often only a third of those pupils who start a course finish it. One of the greatest difficulties, especially for older aspirants, is that of mastering the Morse code.

Our knowledge of the physiological process of learning has advanced to a stage today at which we know that the speed and ease with which a piece of information stored in the brain can be retrieved depends

on the frequency with which use is made of this information. Applied to CW, this means that constant repitition is the *only* means of increasing CW speed.

Careful psychological preparation is also of greatest importance in mastering the Morse code. The instructor who paints a picture of CW as being a necessary evil which has to be learned to pass the examination can do irreparable damage by infusing into his pupils a subconscious rebellion against it. If, on the other hand, the instructor knows how to inspire his pupils with the possibilities CW offers as an internationally understood radio language, then he will have done much to smooth the path of learning.

Some years ago the DARC brought out a Morse code on discs by DL1FL for the purpose of self-instruction. This course starts completely from scratch and gives aspirants the possibility of acquiring examinational-level CW even if they are unable to attend their local club.

The DARC has also taken a step in a somewhat different direction to assist isolated would-be amateurs. Since 1964 vacation courses in all aspects of amateur radio have been held regularly. The very first of these was held in Benediktbeuren, a name which will doubtless be remembered for a long time. The participants in these courses pay only for board and lodging, usually at the maximum youth hostel rate of around DM 6.50 ($1.75) a day.

The courses held in 1964 and 1965 were directed exclusively at bringing pupils up to the DE level. The experience gained with them quickly led to an extension of these 2–3 week courses to radio amateur examination level. Up to the time of writing some thousand aspirants have benefited from these courses, which now are organized annually by five of the DARC's geographical districts. Of this 1000, approximately 600 have passed the DE examination. A further 225 have qualified on the spot for the transmitting license and around 175 for the VHF transmitting license (56% full licenses and 44% VHF licenses). Among the 600 DEs were a large number who, through their own efforts, were able to take the license examination soon after their return home.

It should be added here that the total of 160 consecutive hours cannot be considered sufficient to give a person all the knowledge required to pass the transmitting license examination. It does not include the repetition and training required in the form of homework, neither does it allow for time for reflection, a process which is indispensable if the newly acquired knowledge is to be thoroughly absorbed.

Nevertheless, these "Jugendlehrgänge," or "youth courses" as they have become known, make it possible to halve the overall time required to pass the amateur's examination. As a rule-of-thumb it can be said that it brings this time down to about five months. The term "newcomer course" would perhaps be better than "youth course" as the ages of the participants can lie anywhere between 15 and 66 years! Considerable problems are caused for the instructors – most of whom are not teachers in the true professional sense – by the wide variations in learning capability as well as the variations in the previous education of the participants. Especially for CW, smaller groups are rapidly formed comprising pupils of approximately the same level, in order to speed up the process of learning. Discs, tapes and Creed Morse senders are employed to adapt the pupils to actual examination conditions. Generally speaking, the best learning aid is the enthusiasm of the participants themselves and their determination to acquire the necessary knowledge as rapidly as possible. During the evenings one or two additional films are usually shown, often loaned by the industry or the Bundespost. Intermediate examinations provide the opportunity for everyone to test his knowledge. At the same time, the closely-knit community which springs up is of great help in bringing to the participants the true meaning of the great radio amateur brotherhood. This often goes so far that participants maintain contact with each other years afterwards and sometimes even visit the next year's course to operate the club station which is always a feature.

As it cannot be expected of qualified instructors that they spend three weeks vacation away from their families and, in

addition, have to pay for their own board and lodging, the DARC has undertaken to pay their expenses, including lodging, up to a figure of DM 30 ($9) a day. The number of instructors is limited to four per course, with a maximum of ten pupils per instructor. In the seven years that this program has been underway the DARC has spent some DM 50,000 ($15,000) for this purpose. Alone in this year the figure is almost DM 15,000 ($4,500) for this purpose. All other expenses have to be met by either the DARC district or the participants themselves. One reason for this can be found in the fact that the DARC, of its own wish, is completely separate from the state and official organizations, and receives no subsidies whatsoever from the Government.

In addition to all the above the DARC Youth Committee has organized three weekend seminars at the Hoher Dörnberg in Hessen for the benefit of the district youth committee members and to enable instructors to share their experiences.

There is today a noticeable trend in German schools towards courses which not only acquaint pupils with the increasingly technical life around them but also encourage them to make optimum use of their spare time. In keeping with this trend, many schools have formed groups of pupils interested in amateur radio. Several of the Länder (the administrative regions in the Federal Republic of Germany who, among other things, exercise complete authority in all matters of education) are now actively encouraging amateur radio in schools in an effort to interest pupils as young as 12–14 years in all technical matters. For example, in the Schleswig-Holstein Land a group of licensed teachers has been formed withthe aim of passing on their experience to other teaching staff under the motto "Amateur Radio in the School." A book with the same title has been written by DLINP as a further teaching aid, and in September of this year a fulltime amateur radio instruction course lasting one week was held in Heide, which eight teachers attended.

One difficulty, of course, is the relatively short life of these pupil's interest groups, in which knowledge of the subject at hand at the beginning is literally zero. For this reason, the greatest chances of success in interesting pupils in amateur radio are assured at grammar or high schools or in vocational institutes, in which however the pupils unfortunately often have other interests of a non-radio nature.

In schools, amateur radio activities are normally limited to those of the short wave listener. It is interesting to note in this respect that the Federal German postal regulations do not specifically permit reception of amateur transmissions within the terms of reference of the normal entertainment radio license; this situation sometimes leads to a certain confusion. As is the case in practically all western countries, the Federal German amateur transmitting license restricts operation of a transmitter to those persons possessing an amateur license. This is sometimes considered a hurdle in school radio clubs, where it is often considered desirable to allow pupils to obtain practical transmitting experience in the same way as someone learns to drive before passing his driving test.

A further extremely well presented teaching aid is the book *"Schulamateurfunk"* by DK3JI. To this must be added a whole series of books by amateurs dealing with the theoretical and operational aspects of amateur radio and designed for self-instruction. Unfortunately, the DARC has not yet found it possible to publish a reference work of this nature, as the German amateur radio organization is still not strong enough to employ its own team of technical experts as is, for example, the case with ARRL.

Despite all this, it can be maintained that German amateurs are doing their part towards insuring that the tradition of amateur radio is carried on within the definition of the ITU Radio Regulations, article 1 no. 78, which says:

> *"Amateur Service* – A service of self-training, intercommunication and technical investigations carried on by amateurs, that is by duly authorized persons interested in radio technique solely with a personal aim and without pecuniary interest."

...DL1FL

LETTERS

ou goons don't ever proofr
l sy
b nch of rocks
you ignored my comments in
I insist that you print ev

NOV COV

Your November 73 cover is in very poor taste but does indicate the mentality of the staff of 73. Although I am not in agreement with Mr. Walker in many instances, amateur magazines are not the place for your kind of politics.

Jo Wood W1AYG

I do wonder where you think the place is for amateur radio politics if not in the ham magazines? Perhaps you are used to letting the government trod you into the ground and wish to just give up without a fight, whether you are right or not. Thank heavens not all amateurs are that willing to knuckle under. . . .wayne

IRS

I read about your battle with the IRS. I concur with everything you said. Can't see why our U.S. Senate allows the gestapo unit, IRS, to operate in the manner they do. You have my sympathy and I wish you the best and hope you come out of this smelling like a rose.

I know what you are going through. A few years ago I was in a small business and was checked by the IRS. I am bound to say they are the biggest bunch of liars, crooks, cheats and thieves I have ever had any dealing with.

You are doing a wonderful job with 73 for ham radio; also with the FCC for us hams. My hat is off to you and more power.

Enclosed is a stamped, self-addressed envelope for 4 copies of your news letter for my congressman and representatives. I sure will mail it to them.

name withheld (W4 - - -)

SIR

Your editorial is right in tune to the times! I hope you make out OK with the IRS; they need to be put in place.

Henry WA4HXZ
West Palm Beach FL

MORE IRS

As associate of mine (a ham radio operator) showed me the latest issue of your magazine 73, and I noted with interest your current problems with the IRS.

Liberty Lobby has sponsored a considerable number of Tax Protest meetings across the country and one of the results has been a book, published by us, and written by Dr. Martin Larson, our Tax Policy Consultant.

Dr. Larson has been fighting the IRS for about 30 years, and successfully. In the book he tells the story of other tax rebels, some of whom have gone to jail and some of whom have fought the IRS to a standstill.

I am sending you a copy of the book, *Tax Revolt, USA*, with my compliments. I know you will enjoy it and I hope it eases your mind some what to find that many others (about 13,000,000 according to the IRS) are refusing to bow to the excessive demands of the IRS.

Another reason we want you to have the book is because we have a club net, called the Liberty Net, which meets every Saturday with George W4BVU as our Net Control. Join us if you can.

Let me know if you feel we can be of service to you.

Robert M. Bartell
Los Angeles CA

ANONYMOUS LETTER

This letter is not for publication, but I want to point out that I am in complete concurrence with every word you have written.

Personally I am in the same spot as you except that they claimed a $40,000 error that they cannot prove, but do accuse me of, and they have "lost" 20 envelopes of records and countless checks. Do they apologize? No! An ex accountant who could not make it on his own is their expert auditor. I have been treated as though I were a criminal and subjected to constant insults. I have even had the same problem with lawyers as you.

I think that magazines and newspapers should publish the criticisms of the IRS and perhaps this would help to stop them using their powers as a weapon to discredit taxpayers. Do you think there are enough of us to act as a body?

name withheld (W7 - - -)

RIS

It's mighty refreshing to read the real journalism which I've seen in my recent subscription to 73.

Your tax difficulties show clearly that our country is getting into serious trouble.

You bet the IRS goes after the small guy! My argument with them involved $600 which I am unable to pay at this time. They wouldn't agree to payments of $30 per month (I make $125 a week); they wanted $50. Why? Because of the big fat savings account of $100 and the extravagant $5 per day which I spend for food, booze and cigarettes.

The $65 I paid a lawyer was an absolute waste. He sided with them, compromised my position, and won't refund the fees promised. He says I'm being "unreasonable." He also feels I'd be wasting my time writing my congressman, and that not enough money is involved to try for a two-year injunction.

Going after the small guy? And how! Walk into the waiting room of the Collection Division here in Washington and you won't see anybody who looks like they make even $100 a week. I was the only white person there! War on poverty, perhaps? Don't tell me this doesn't fatten the welfare rolls.

Using the power of an audit to stifle a free press? Right! There was a columnist in the Washington Star-News (formerly Evening Star) who wrote about these things. While I don't read the paper regularly, I can't seem to find this column any more. Funny about that, isn't it?

And how about the fundamentals? Didn't we once fight a war over this kind of taxation? Wasn't the income tax unconstitutional until passage of the 16th Amendment?

You can sign me up for this fight. I'm thinking of enclosing a couple of dead cockroaches with each of my payments.

More practically, I am prepared to distribute reprints of "73 a Little Thinner" in my apartment house (1700 tenants), at work (grade lessons for National Radio Institute), from the taxicab which I own and drive part-time, and possibly through the Washington Area Cab Drivers Association of which I am a member.

I hope that your office gets stacked right up to the roof with letters like this, and that somehow, we can stop this.

name withheld (W3 - - -)

CHC

Do you still have available the Certificate Hater's Certificate? I sure would like to have one. I hate ham certificates with equal malice toward all. I have been a ham since 1958 and I have never gotten any certificate from anybody in ham radio with the exception of your Life Subscriber Certificate, which I can't even find. I used to take it out of its grimy envelope and grimace at it once in a while, but I can't even do that any more. Frankly most of my hate involves hating other peoples' certificates, but this is normal since I don't have one of my own.

So please dig around and see if you can come up with one. It would be very impressive to hang up in my shack. Then when people come in to see all the expensive equipment that I use to talk to hams as far away as Liberty Lake (15 miles) with all the reliability and quality of a tin can on a

string, they can look at the CHC before they walk out shaking their heads.

John Kenney W7COI
Spokane WA

WANTS SB-110A

Can you help me? I've been looking for a year trying to find a used SB-110A. Every time they advertise one in QST I miss the boat because QST always seems to send me mine two weeks after it hits the stand.

Do you know anyone who would sell their SB-110A or have any ideas?

D. R. Kight WA5RER
Box 212
Spencer OK 73084

MORE HELP

About 3 weeks ago I bought an E. H. Scott Co. "RCH" Radio Receiver Set and I would like to know if your readers know someone who has a manual. If there is any charge I will gladly pay. I want to get my receiver working. Thank you very much.

Scott Tonelson WN2LXN
217-37 Corbett Road
Bayside L.I. NY 11361

QSLs

After reading my October issue of 73, I gazed at the back cover in disbelief. QSL's for a penny apiece? Impossible! I read on and discovered it was true, it only makes sense that you could make them cheaper. The next day I told the kids in school that belong to our club and we decided to get them.

I am enclosing a facsimile order blank because I don't want to rip up my 73. Please send us our 500 right away. We would have ordered 2000 but our club is just now recovering financially from Field Day.

Bob Ternes WN8MQD
North Ridgeville OH

ANYONE STILL AROUND?

I was a Radio and Telegraph operator in France with the Radio Section Signal Corps First and Second Army. There must be some one of my pals who is still interested in radio; The only one I have met is a Frenchman who was a good friend during the time I was attached to the French 7th Army. Just thought that someone may see this.

Walter R. Lafferty W2GJH
119 Ayers Court, Teaneck NJ 07666

HELP DELAY

In obtaining some surplus electronic gear I have become the owner of a beautfiul piece of equipment called "Envelope Delay Test Set" Model 4508 Mfg. by Sierra Electronic division of Philco-Ford. According to the manual it "measures envelope delay over a frequency range of 300 Hz to 110 kHz and in addition measures the frequency of the transmitted or received signal. Both the delay and the frequency measurements are displayed on individual direct reading digital readouts. Measurement of delay is made in either of three modes: end-to-end with return reference, loop-back, or end-to-end. The test set may also be used as a frequency counter of the range 1 Hz to 1 MHz.

It is comprised of a transmitter which generates a modulated carrier signal, a receiver which amplifies and demodulates the incoming signal, and logic and control circuits which process the envelope delay and frequency signals and which count and display the envelope delay and frequency information and convert it to analog form for external recording

It is mounted on a 5¼ inch panel and is all solid state with sixteen circuit boards and numerous integrated microcircuits.

This thing is too beautiful and sophisticated to cannabalize and appears to be in excellent condition. It looks like new and all the controls seem to work including the nixie tubes.

To someone somewhere this must be a valuable piece of equipment. If you can enlighten me as to who or what used it and why, it would be greatly appreciated.

Wayne O. Wallace, M.D. WØVPY
317 N. 3rd St.
Atchinson KS

OLD FRIENDS

When one ups and moves his home QTH, everything in sight gets packed and goes along. So it was when Sharon and I decided to move to Los Angeles. We put everything into those large movers' cartons, called Red Ball Van Lines, and then took off west in our Ford.

Little did I know the "nostalgia attack" that was to take place when we began to unpack. For within one of those aforementioned boxes I found my old 73 magazine collection, dating back to November of 1960 (37 cents, remember?)

I remember the first time I met you. It was the day when Larry WA2INM and John WA2FMF went "Little Red Wagon mobile" with a Gonset III, a 2m CushCraft Halo and 12V battery for power. That was 12 years ago.

I remember the very first article I ever had published. That was the review of the then new Clegg 99er in May of 1962. Boy, was it a great feeling to see it in print, even though it was far from being the epitome of amateur radio journalism.

May I call your attention to April 1962, page 64. It was Roy's article *FM to AM*. Perhaps, in light of today's trends, I should write a sequel entitled *AM to FM*.

Most of all I guess I remember that afternoon we all spent loading the U-Haul for your move from East 15th Street to Peterborough. I still find it hard to believe that the five of us loaded all that "stuff" into that truck. My back aches just to think of it.

It is sort of amazing to realize that all this time has gone by and how trends in ham radio have changed. SSB and FM have replaced AM on VHF, we now have an amateur satellite repeater and Novices can use VFO's.

Though I've lost track of most of the old 6m AM crowd, I'm still very close friends with John WA2FMF/6, Dave ex-WA2LFK and Larry WA2INM. John is now a Los Angeles policeman (also my landlord). Dave is a systems analyist in Albuquerque, and Larry now is sole owner of the business he and I started in Brooklyn four years ago.

If you print this, and if any of the old crowd from 6m in the 1960's read this, get in touch, because I'd love to hear from you.

In closing, let me say that we all change with time. 73 is now quite different than in 1960 or '61. But it is in keeping with the times, and I'm glad to see it. Especially the November cover.

Bill Pasternak WA2HVK/6
14732 Blythe St - 17
Panorama City CA 91204

PROSE

I have enjoyed your magazine for the few years that I have been getting it and am especially pleased about the recent articles about PROSE. Give him HELL, and don't let up 'til he knows that he isn't dealing with a bunch of kids. All this pushing around isn't necessary and damn well not appreciated.

I understand the FCC is fairly swamped with applications for repeater information and applications, but I don't think they are so busy as to allow an application for an amateur license to be as neglected as mine. Last June 17, after several communications with them, I sent them a check to cover the cost of reissuing my former call, which had been lapsed for 5 years or more, and I still have not received it. I got a letter from them saying that I would have a further communication and my old call back in two to three weeks. That was early October, and still no license, and no word.

I'd like to see more "home study" type things offered via cassette tape Maybe the higher class license material or some such other material.

J. Glen Skagerberg
Tujunga CA

OUTSIDE VIEW

As an outsider who probably hasn't the faintest idea what he is talking about, it seems to me that there are two types of amateurs currently on the air.

The first is like a sleepy old dog. He lays with his eyes closed and dreams of the good old days, and talks with all his old timer friends. He has finally saved enough for his dream rig and is content to enjoy it.

The second is the newcomer about my age, thirty; he has a little money to waste and is busy building all those gadgets with the integrated circuits and showing off his super power, digital read out, expensive portable to all the neighbors.

There is however a new dog on the block. He is the sleek purebred CB man. He has money and popular appeal on his side. In the words of a local CB'er, the FCC wouldn't dare to try to confiscate or fine them for being illegal. They have organized clubs and lots of money on their side, and if the FCC did get tough there would be such a howl in congress they would have to back down.

It seems to me that the radio amateurs of the United States had better wake up and start thinking more about the kids in school who are mildly interested in electronics before they give up and settle for an appliance and a CB license.

I happen to think a great deal of the hobby of amateur radio, but then I found out about it from a dedicated blind ham while still in grade school. I hope someday to teach my son, if there is any amateur radio left. I sometimes wonder if anyone caresany more. I just hope some of the hams out there do. I also hope to join them one of these days soon.

Thank you for reading this and helping me get it off my chest.

Vernon R. Wheeler
Denver CO

WALKER

Just wanted to let you know I have written Georgia Senator Sam Nunn and Barry Goldwater. Got a very interesting letter back from Sam Nunn. Seems he's going to do some talking on behalf of us hams here in Georgia concerning A. Prose Walker. I was surprised to find that old boy ain't so far up on the totem pole at the Federal Candy Company as I thought he was.

I have a suggestion for ole Walker – he should stick his finger in a bucket of water. If there is a hole left when he pulls it out it will prove he is indispensable. Otherwise he had better shape up!

Marvin Banister K4PGY
Albany GA

DEFENSE PROSE

The radio amateurs should take a realistic look at the FCC and Mr. Walker before they tear Mr. Walker apart. For instance, if you were a businessman and could sell 250,000 items for $9.00 each or 250,000 items for $20.00 each what would you do? Our government has issued directives to its agencies ordering a cutback in spending and an increase in agency income. Mr. Walker has no doubt received such a directive from the FCC Commissioners. What else is he to do than follow the directive?

The radio amateurs must realize to get power in Washington they must have a professional lobby to represent them. Presently the League is too interested in selling magazines to fully represent the amateurs. If the radio amateurs were to hire a professional lobby we would no doubt receive the goals the amateurs are seeking.

The CBers have done this and have gotten many of the goals they were seeking. I'm not for the CBers, but the amateurs should take a lesson from them and get a professional lobby in Washington to represent amateur radio.

Ken Anderson K7LDZ
Great Falls MT

BURMA

I was from Burma; an oldtimer having got the amateur license in 1928. My call was XZ2AD. Owing to the ceasing of operation of my Company – the American International Underwriters Branch Office in Burma when the Military Revolutionary Government came into power, I left the country with the family and n ow am trying to get settled in the U.S.

Recently I took the exam and got WA6SNC, as a result of Goldwater's legislation.

I worked hundreds of stations of USA from Burma and those who haven't received my QSL can claim now.

U Hla Oung WA6SNC, Ex XZ2AD
995 Pine St., No. 502
San Francisco CA 94108

JORDAN

Let me compliment you on the September issue of 73. Those pictures and the story of your trip to Jordan were just out of this world. Only wish I could have been with you. I am sure if all the hams that have read your article knew of a central location that they could send their left over and surplus equipment for delivery to Jordan you would soon have a plane load.

John Petrow W2GHY
Medford NY

Send it to us marked "FOR JORDAN."

KA SSTV

I am stationed in Japan, have been here for a number of years and hope to be returning home within the year. My call is KA2AI and was recently a member of the DX-pedition to KA1CQ on Iwo Jima. There are a couple of KA's now active on SSTV, KA2DF, DA2RG and myself. I run a KW on SSTV on 20m daily and am looking for any stateside video I can find. I wish the guys back there would turn their antennas northwest and look for us! I am using JA "HAMVISION" equipment, both camera and monitor.

Samuel S. Yates KA2AI, K4KAI

METRIC RULES!

I think it is great that you have gone metric in your articles. The big problem for antenna builders is to find a metric rule or tape over 30.5cm (12") long. On a trip to Guatemala I was able to buy a 2m folding rule (STANLEY No.714 M-E) and a 3M tape (STANLEY P3ME) both made in the USA. I wonder now if they can be purchased here?

Once you start using a metric rule for home carpentry you will wonder why anyone insists on using inches or feet with the complicated fractions. Try adding a 17 3/16" length to a 6 3/4" measurement without making an error. Then try 47cm plus 18cm. The odds of an error are greatly reduced.

Keep with the metric measurements and you will have your readers trained to think metric in a short time.

Richard I. Haxton WA31VB
Boyds MD

LISTENING .73–.84

It's a beautiful Christmas day, everyone has opened their presents, but you find you need some milk and eggs for breakfast. You look out the front window and the "OK TO DRIVE" indicator is flashing green. So you proceed to drive to the store a few miles away. On your way, you wave to the sentries in their cubicles placed at strategic positions to nab you if you commit any infraction of the law. You drive quickly (as legally possible) to the store. You park, run in and out, jump into your car to find the red light flashing on the dash."NO DRIVING." So there you are, stuck and no way to get home. You reach for your car phone to find out what's up. The reply goes something like this, "Because of the lack of traffic, the sentries have been sent home to be with their families on this day of peace. No one drives the streets without someone watching."

It's just a story, but it seems that this is the situation with repeaters. The repeater is turned off when control goes to the bathroom or wants to be with the wife. I would be willing to bet that there are few repeaters that are operated quite this way. Just think, FCC, if they were, you would have a lot of mail to pour through. I feel that very strict controls on repeaters will bring a response from the ham public, which we need to keep from being walked on.

1984 is here in 1973 – My, how time flies when you're having fun.

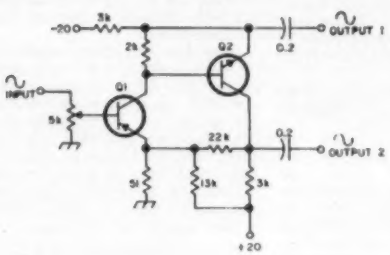
John Ellingson K7OSK
Rochester WA

Let's see what happens in '74 . . .

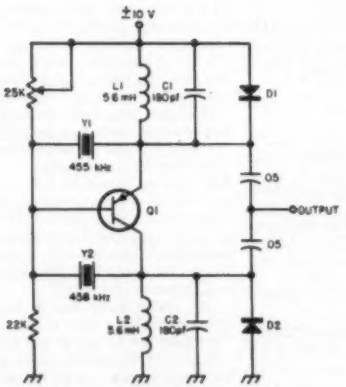
CIRCUITS, CIRCUITS, CIRCUITS...

The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.

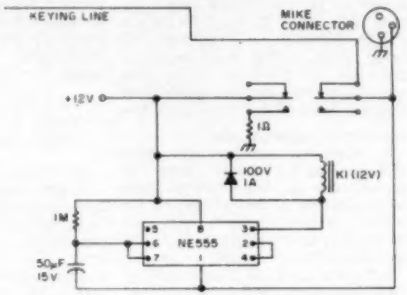


This phase splitting circuit provides two out of phase signals for driving a push pull amplifier without an expensive transformer. The gain of the stage as shown is 150, but this may be adjusted by changing the value of the 22K feedback resistor. Q1 and Q2 are a complimentary pair such as the 2N652 and 2N388 or 2N2430 and 2N2706.

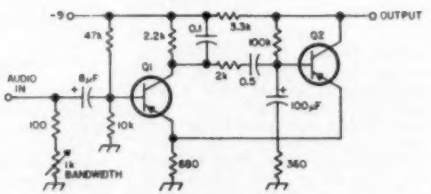


Q1- 2N384, 2N525, SK3004, TI XM03
D1, D2- GENERAL PURPOSE SILICON DIODES

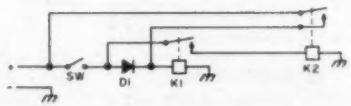
This two frequency crystal oscillator changes frequency by simply reversing the supply voltage. When the supply voltage is changed the transistor inverts itself; usually transistors may not be used in the inverted mode, but in an oscillator a gain of only 1 or 2 is needed and this circuit provides a novel and simple way of obtaining two frequencies from a single stage with a minimum of switching. Q1 – SK3004 D2 & 2 – silicon.



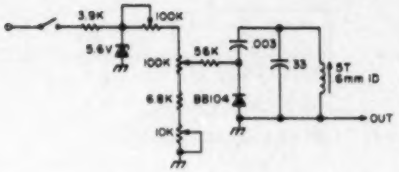
A timeout timer that shuts off your rig before you close down the repeater. With the values shown your rig will turn off after 1 min. 59 sec. The 1Ω resistor is wired in as a joke (build one of these for a friend!) as it will provide a "sniffable" indication of the rig's shut-down.



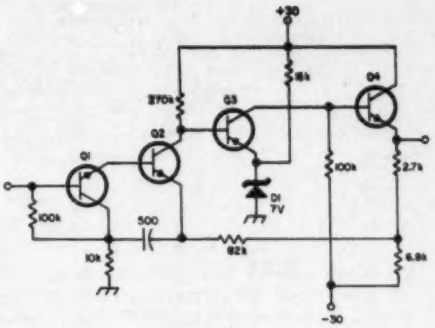
This audio filter uses a 1000 Hz Wien bridge circuit to provide bandwidths from 70 to 600 Hz wide Q1 and Q2 are SK3004, GE-2 or HEP-254.



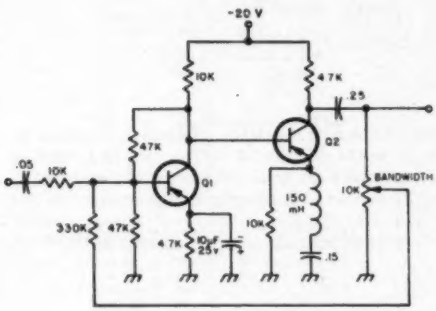
This circuit is handy for pentode or tetrode power amplifiers. Relay K1 switches on first and off last, K2 switches on last and off first. K1 controls plate voltage and K2 controls screen voltage. Thanks to W8UFN.



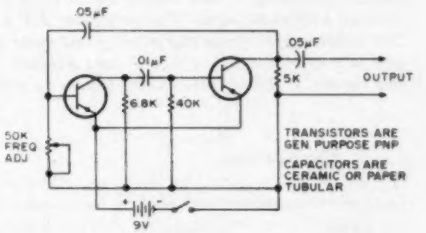
A 12 MHz VFO adapter for the TR22 that can be plugged into its crystal socket. After applying +12V to the switch terminal, the unit can be tuned via the 10K variable resistor. The two 100K units determine bandset and linearity.



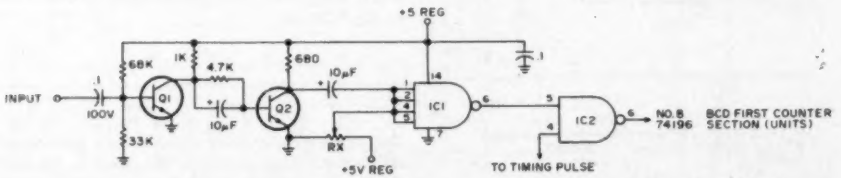
This preamplifier provides 11 dB gain from 0.5 Hz to 2 MHz and has an input impedance of 32 megohms. Transistors Q1, Q2 and Q4 are SK3020 or HEP-53; Q3 is a GE-2 or HEP-52.



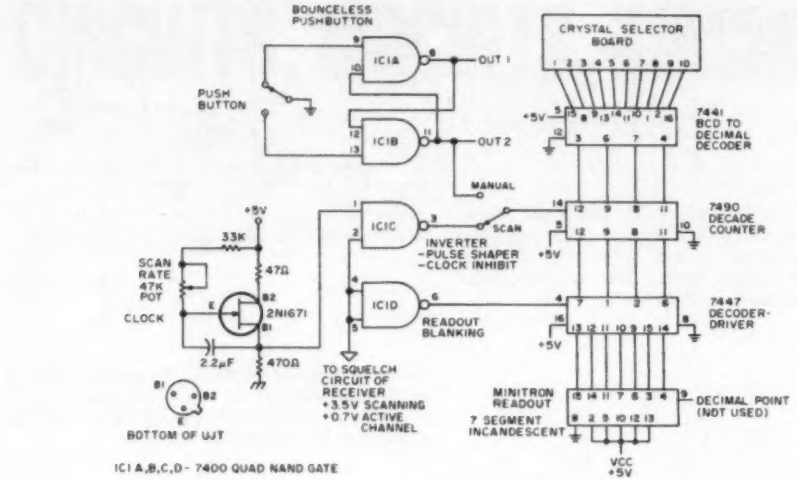
This simple audio bandpass filter may be narrowed to the limits of unintelligibility. At a bandwidth of 80 Hz, it provides about 20 dB gain The input is connected to the phone jack on your receiver while headphones are connected across the output. Q1, Q2 – SK3004.



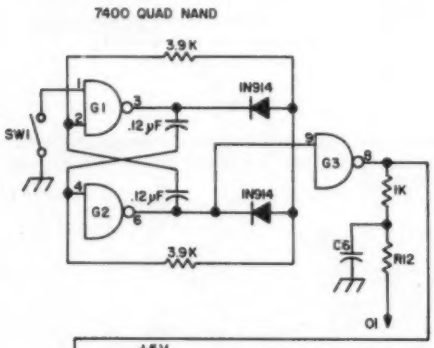
An audio signal generator for checking modulators, audio amps and bandpass filters. Thanks to WA3SWS.

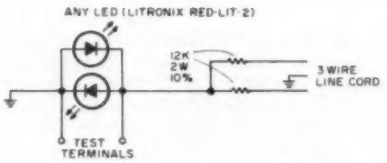


A counter input circuit. This input circuit has operated from 450 kHz to 65 MHz. Sensitivity about 50 mV. For some reason it will not read audio frequencies. Rx is 5K ohms. It should be adjusted to trigger the 7413 at the highest frequency It would be better to measure each side of center tap after adjustment and use two fixed values and variable of only 100 to 200 ohms. The + voltage on pins 1,2,4,5 of the 7413 will be between 1.2 and 1.4V, but it does have to be adjusted right on the trigger threshold for highest frequency operation I used Ken Macleish's logic and control circuits in my counter and only 5 digits, with a change in timing and decimal point. I tried three or four 7413's and they all counted to 65 MHz. A 7490 won't do it – you must use a 74196 or 8290 in the first counter section. The 74196/8290 and 7490 are not interchangable, the 74196 clears on a negative going pulse, a 7404 will take care of that. Q1,2 – any 600 MHz NPN. IC1-7413. IC2-¼ 74H00 gate. Thanks to W5HCO.

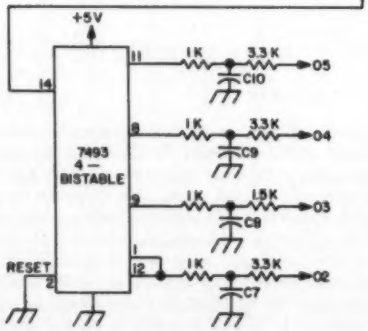


Integrated circuit channel scanner: This unit is capable of scanning a series of channels in a receiver by switching crystals in and out of the first oscillator. It works like this: A UJT is used as a clock to produce a series of pulses. This particular UJT is fairly expensive ($2 to $3) but it operates well on 5V. The pulses are of the wrong polarity and quite noisy To correct both situations, they are fed into one gate of a quad two-input NAND gate, a 7400. The output of this gate is connected through a switch and thence to the counter. Note: bypass 5V supply frequently with .01 to .1 μF. Thanks to VE7BH4.

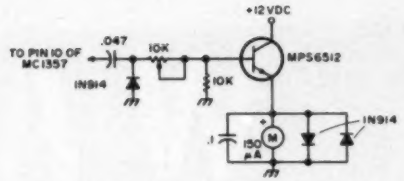




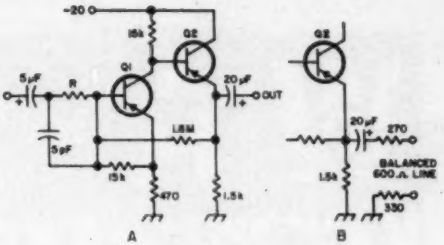
This super simple diode checker using LEDs will check the polarity and condition of diodes. Thanks to Noel Calvin



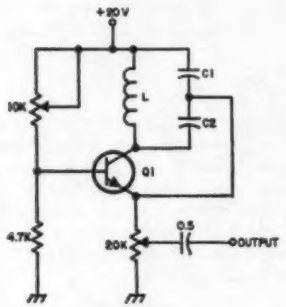
This frequency dividing signal source gives four X2 submultiple outputs of the frequency at 01, or five different harmonically related outputs from a signal oscillator. To change the fundamental frequency of the oscillator replace the two 3.9k resistors and the cross-connected capacitors with values calculated according to 1.6/RC, with R in ohms and C in farads. R12 should be varied to make the 01 output match the divided outputs. The capacitors C6–10 are optional and can be added to reduce the harmonic content of each output. They are chosen so their reactance equals 1k at the output frequency. From "Handbook of IC Projects," by Tab Books.



An S-meter circuit for Regnecy FM rigs.



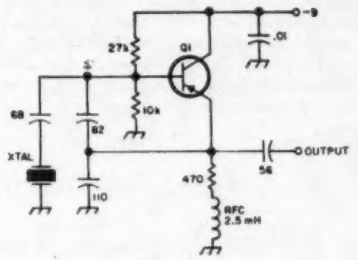
High impedance preamplifier provides up to 1.2 megohms input impedance; the exact value depends upon the build out resistor R. Both Q1 and Q2 should be a DK3004, GE-2 or HEP-254 A balanced output for reduced hum and noise may be obtained by using the padded output in B.



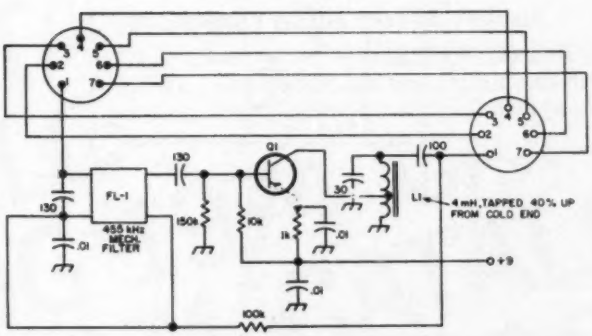
Q1 - 2N2925, 2N3392

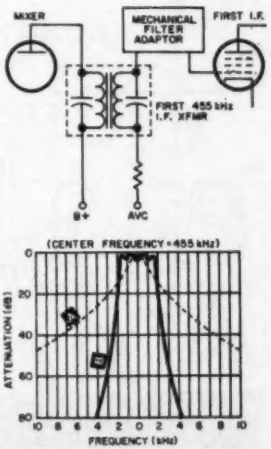
FREQUENCY	C1	C2	L
50 kHz	3500 pf	1500 pf	10 mH
80 kHz	2200 pf	910 pf	5.2 mH
100 kHz	1800 pf	750 pf	4.7 mH
200 kHz	910 pf	390 pf	2.2 mH
455 kHz	390 pf	160 pf	1 mH
1000 kHz	190 pf	75 pf	047 mH

This simple circuit provides an extremely stable BFO. The frequency of oscillation may be tailored to your needs by simply choosing the proper tank components listed in the table.

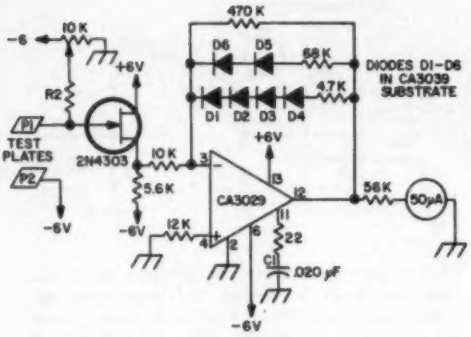


This crystal oscillator will oscillate with any crystal between 3 and 20 MHz with no tuning whatsoever; overtone crystals will oscillate on their fundamental in this circuit. Q1 is a GE-9, SK3006 or HEP-2.

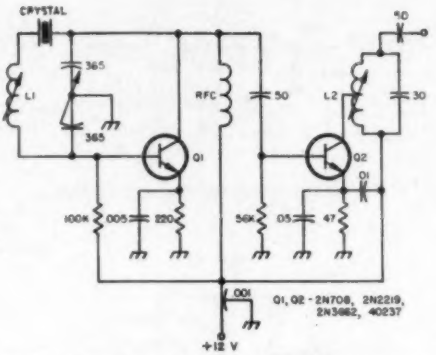




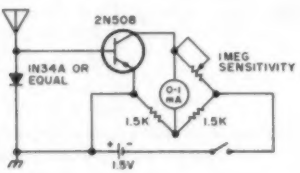
The selectivity of inexpensive communications receivers may be substantially increased by the addition of this mechanical filter adapter. The transistor is used to make up for the 10 dB loss through the filter. The typical passband of a receiver without the filter is shown by A in the frequency response curve; the mechanical filter adapter results in curve B. Q1 should be a SK3008 or HEP-3.



A conductivity checker that will easily find a home in anyone's darkroom. With the test plates immersed in a flowing-bath print washer, the meter will indicate a lowering amount of conductivity as the hypo is washed away from the prints. When the meter indication approaches the measurement obtained from pure water, the prints or film will be nearly hypo-free. From "Handbook of IC Circuit Projects," by Tab Books.



This variable crystal oscillator (VXO) may be used to vary the frequency of an 8 MHz crystal 4 or 5 kHz when the 365 pF dual variable is tuned through its range. When multiplied to two meters or 432, this provides a very stable variable frequency. For 8 MHz crystals, L1 is a 20—25 uH slug tuned coil; L2 is chosen to resonate at 8 MHz with the 30 pF capacitor.

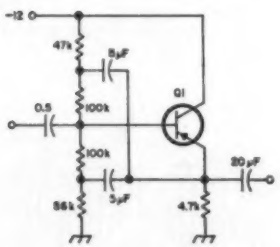


A general purpose field strength meter for checking antenna performance. Thanks to WA3SWS.

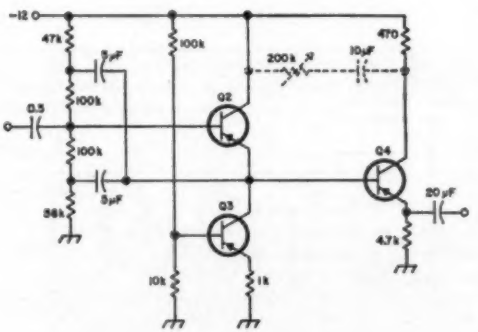
Table 1

Crystal	L_1		L_2*
3.5 MHz	35-60 μH	Miller 4509	80 turns #36, tapped at 27 turns
5.0 MHz	24-35 μH	Miller 4508	62 turns #36, tapped at 21 turns
8.0 MHz	16-24 μH	Miller 4507	40 turns #36, tapped at 13 turns
9.0 MHz	16-24 μH	Miller 4507	36 turns #36, tapped at 12 turns

*Wound on ¼" slug tuned form.



(A)



(B)

This high impedance preamplifier provides up to 20 megohms input impedance and has a frequency ressponse from 10 Hz to 200 kHz. Circuit B was developed from circuit A by replacing the emitter resistor in A with Q3 and adding an emitter follower to reduce loading The input impedance is further increased by the components shown by the dashed line. All transistors are SK3005, GE-9 or HEP-2.

Continued on p. 177

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1974 CATALOG 1974 CATALOG 1974

IN THE NEXT 31 PAGES you will find a small portion of the inventory at A & W.

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Crystals in stock for Regency (all models), Standard (all models), Drake (all models), Tempo FMH, SB-144, IC20-21, Genave, Trio and Kenwood.

All standard repeater and simplex channels

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- ☐ 10 watt R.F. output.
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- ☐ Maximum 3 amp current drain.
- ☐ 19" Rack Panel Mounting.
- ☐ Size: 19"w x 5"h x 9"d.

$698.00 Suggested Amateur Net Price

220 MHz & 450 MHz versions available

2M FM TRANSCEIVER SRC-146A

Solid state, 2 watt, 5 channel, hand held transceiver.

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NEW 22 CHANNEL BASE STATION
SRC-14U

Ultimate in a 2M FM Transceiver features:

- ☐ 22 channels
- ☐ AC & DC supplies Built In
- ☐ 10W (1, 3 & 10 selectable)
- ☐ Receiver offset tuning
- ☐ VOX
- ☐ Three Front Panel Meters
- ☐ Plus many more exciting features.

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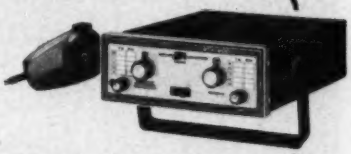
- Operation over the entire 2-meter band (including MARS and CAP frequencies) *without* tuning
- No automatic shutdown on SWR bridge. Operate with mismatched antenna *without* damage, due to balanced emitter output transistors
- Lowest AM detection level of any comparable unit (including many commercial rigs)
- Power: the GTX-2 and GTX-200 boast 30 watts nom. output
- Lightweight: manufactured to aviation industry standards
- High-sensitivity receiver pre-amp included as standard (GTX-2 and GTX-200)
- ¼" phone jack included as standard (GTX-2 and GTX-200)

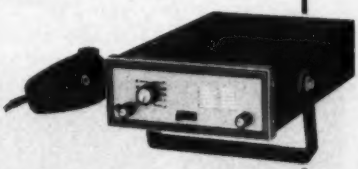


GTX-200 **$269.95***

(30 watts output power, nom., up to 100 channel combinations)

GTX-2 **$259.95***

(30 watts output power, nom., accommodates 10 channels)



GTX-10 **$209.95***

(10 watts output power, nom., accommodates 10 channels)

* Includes 146.94 MHz. Add'l. crystals $6.50 ea.

Genave

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CHECK THESE FEATURES

- 8-10 watts output (minimum).
- Speech clipping.
- Sensitive receiver—.25 μv (max.) for 12 db Sinad.
- Selectivity—Adjacent channel (40 KHz) down 50 db.
- Each crystal does triple-duty, providing a transmit and receive frequency (Crystal Saver Frequency Control).
- Monolithic crystal filter.
- Compact, 7" x 2¾" x 9"

POWER REQUIREMENTS: 12 to 14 VDC
Current Consumption at 13.5 VDC:
Receive: 4 amps squelched, 1.2 amps unsquelched.
Transmit: 6 amps max.
DIMENSIONS: 7⅛" x 3½" x 9¼" deep; 4 lbs. net weight.

RECEIVER

TUNING RANGE: 146.00 to 148.00 MHz, continuously tuneable with reset capability of approx. 1 KHz to any frequency in range.
SENSITIVITY: .35 μv max. for 20 db quieting; .1 μv for reliable squelch action.
SELECTIVITY: 11 KHz at 3 db; Less than 30 KHz at 70 db. Adjacent (30 KHz spaced) channel rejection more than 70 db.
AUDIO OUTPUT: 2.0 watts (min.) at less than 10% THD into internal or external ohm speaker.

TRANSMITTER

TUNING RANGE AND CONTROLS: Same as RECEIVER.
POWER OUTPUT: 25 watts Min. into 50 ohm load. P/A transistor protected for infinite VSWR.
MODULATION: Internally adjustable up to 10 KHz deviation and up to 12 db peak clipping.

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YOU'LL LOVE OUR

ALL NEW 220 MHz

ALL AMERICAN MADE
SOLID STATE TRANSCEIVER

10 OR 1 WATT POWER OUT/SWITCH SELECTABLE / FULL 12 CHANNEL TRANSMIT AND RECEIVE CAPABILITY

All the advantages of 2 Meter FM . . . away from the crowds. With the HR-220, Regency pioneers the way to put you out on the most exciting ham band ever. The HR-220 is equipped with all the quality features you demand—compact design, big signal power at low current drain, HI/LO power switch, crystal clear reception, superb sensitivity *and* low price.

Regency
the first name in solid state

$239.00 AMATEUR NET

includes plug-in ceramic mike, dash mounting bracket and factory installed transmit and receive crystals for 223.50 MHz.

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NEW HR-6

12 Channel
Solid State
6 Meter FM
Transceiver

Model HR 6
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Designed and use tested to perform against TVI. Designed to utilize the most modern components of the solid state art—integrated circuits, dual gate MOSFET transistor, silicon BET power transistor, etc. Designed with the power in the frequency range to work FM Skip. And, designed and built in America in a compact package that will appeal to your taste and pride of ownership.

Complete dash mount operation . . . does not require black box power hog in your trunk

25 Watts Out

Long Range Signal Capability

12 T and R Channels Independently Switched

144 Frequency Combinations

5 Watts Audio output

Compact for Dash Mount.

SPECIFICATIONS

Power Output:	25 watts Min. @ 13V DC
Frequency Range:	52-54 MHz
Channels:	12 with independent switching
Sensitivity:	.35μV (nom) 20db quieting
Selectivity:	6db ± 10KHz
Audio Output:	5 watts max.
Size:	2½" x 6½" x 9½"

State of the art receiver utilizes MOSFET mixer for superior front end overload and intermodulation performance.

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15 OR 1 WATT POWER OUT/SWITCH SELECTABLE/
FULL 12 CHANNEL TRANSMIT AND RECEIVE CAPABILITY

You'll like the crystal clear transmit and receive performance of this compact, 2 meter unit and so will those listening. The 12 transmit channels are provided with individual trimmer capacitors for the optimum in point-to-point and repeater applications. A HI/LO power switch provides 1 watt output or full rated output. The receiver has an audio output of 3 watts at excellent sensitivity. Solid state, American made quality at a low price.

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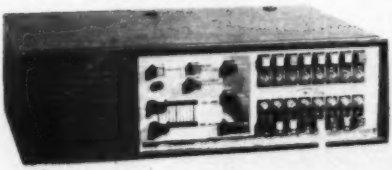

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HiBand and VHF too – PLUS 16 channels to boot.

*** THE 10 CHANNEL SCANNER**

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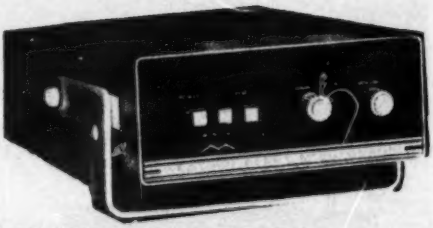
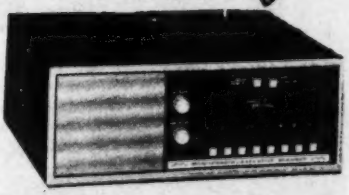


MODEL ACTR Weather Alert Monitoradio. Single channel weather receiver with push button control for instant and continuous weather information; or, for placing receiver on quiet, but alert, status for automatic night or day alarm to urgent weather warnings. Receives signal within 30-40 mile radius of National Weather Service transmitter sites. Consult local U.S. Weather Bureau for details. Operates AC or DC and comes complete with AC power cord, detachable, telescope antenna and built-in 4" speaker. .....$119.00 including crystal.

We plan to be No. 1



This is the most versatile receiver ever offered for monitoring the very busy VHF High Band. Automatic, Tri-Speed Scan Action, push button program control and 8 crystal-controlled channels provide listening capability never before achieved in a single band receiver. The Regency way is the new way to hear both sides of two way signals for police, fire, marine, civil defense, business and other services using this FM communications band.

Regency 2 Meter FM—American made at import prices

NEW Instant access to 144 frequency pairings with 20 watts out on the new HR-212 twelve channel 2 Meter FM Transceiver by Regency

Specifications

Power Output: 20 watts (nom.) at 13.8 V DC
Frequency Range: 144-148 MHz
Channels: 12; crystal controlled
Sensitivity: 0.4 uv, 20 DB quieting
Spurious Rejection: 60 DB

Model HR-212 **$259 Amateur Net**
Includes microphone, mounting bracket and factory installed transmit and receive crystals for 146.94 MHz

for all your 2 Meter FM needs

Model HR-2MS 8 channel Transcan™ with signal search reception and 15 watts minimum output. **$319.00 Amateur Net**

Model AR-2 Amplifier boo 2 Meter FM output power 300%.
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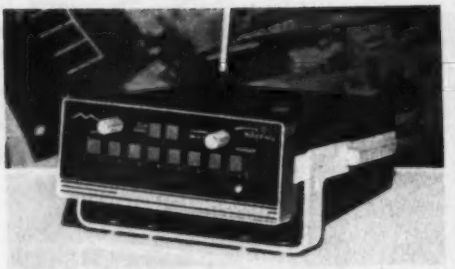

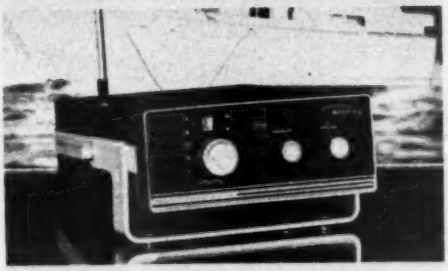
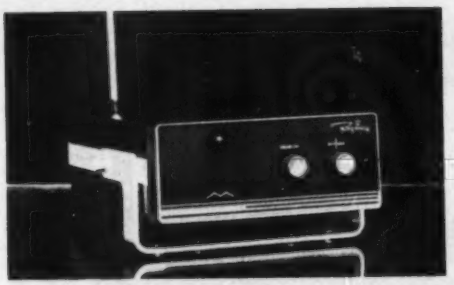
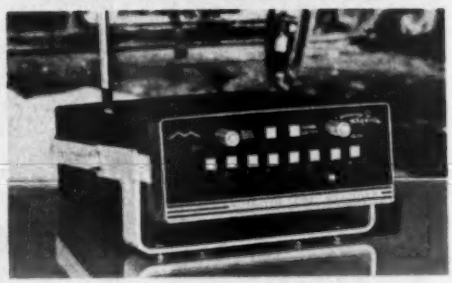

ACTR	10	H/L/U	$169
ACTE	16	H/L/U	219
ACTE	16	H/L	219
ACTE	8	H/U	169
ACTE	8	H/L	159
ACTR	8	H/L	159
ACTE	8	L	139
ACTE	8	H	139
ACTR	8	L	139
ACTR	8	H	139
TME	8	A	149
TMR	8	A	149
TMR	1	A	119
TMR	1	L	99.95
TMR	1	H	99.95
TMR	1	U	100.00

TMR	12	H	119.00
TMR	12	L	119.00
TMR	1	W	119.00
TMR	2	W	124.00
TMR	2	M/W	124.00

We plan to be No. 1

Note Coding: The Letter "E" signifies a table top unit and "R" is a mobile configuration.

U 450–470 MHZ
H 148–174 MHZ
L 30–50 MHZ
A AIRCRAFT FREQUENCY
W WEATHER
EXAMPLE: TMR 12 H IS 12 CHANNEL, MOBILE, 148–174 MHZ.

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Medford, Mass. 02155
(617) 396-5550

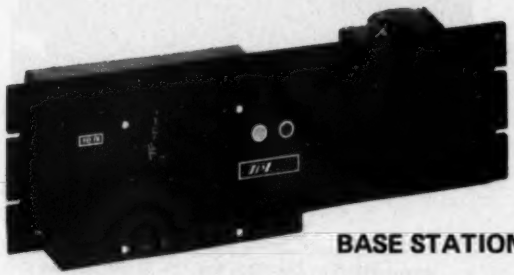
TPL IS 220

A brand new 220 MHz solid state FM transceiver. The 220 TR's power output is 10 watts. The receiver is double conversion with a tunable and crystal controlled receiver. FM is detected by a limiter discriminator featuring full noise saturation for weak signal reception. Sensitivity is typically .5 microvolts for 20 dB quieting. Variable tuning is accomplished in two bands , 220–222.5 MHz and 222.5–225 MHz. Its size . . . only 7"W x 2 3/8"H x 10 1/2"D.

TEMPO 220

Need extra mobile power? Here is the answer. Up to 100 watts or more on 220 for when you need that extra punch. Same high quality TPL construction and reliability.

MOBILE AMP



BASE STATION

Completely self-contained for home operation. Mounted in standard 19-inch rack with power supply and blower.

TPL NOW OPENS THE DOOR TO 220 OPERATION

Other great TPL products . . . . .

PART NO.	INPUT POWER	OUTPUT POWER	FREQUENCY RANGE
PA3-1AE	50-250mw	15-25W	136-175MHz
PA3-1AB	.75-3W	20-25W	"
PA3-1EC	50-150mw	30-50W	"
PA3-1AC	1-5W	35-50W	"
PA3-1DC	6-15W	30-55W	"
PA3-1ED	50-250mw	60-80W	"

PART NO.	INPUT POWER	OUTPUT POWER	FREQUENCY RANGE
PA3-1DD	5-15W	60-80W	136-175MHz
PA3-1EE	50-250mw	80-120W	"
PA3-1AE	.75-3W	80-120W	"
PA3-1DE	5-15W	80-120W	"
PA6-1DE	1-4W	20-30W	400-512MHz
PA6-1AD	4-10W	25-35W	"

FCC type accepted for operation under parts 21, 81, 89, 91, 93, 95. Meets FCC specification: Part 5, subpart C, paragraph 5 103 (a).

Other products:
VHF FM 25-50 MHz Class C amplifiers
60W UHF FM Class C amplifiers
90W UHF FM Class C amplifiers

Wide band linear amplifiers in any frequency range on special order.

For complete specifications on any of the above units please write.

TPL amplifiers are for commercial applications. For non-commercial uses please contact your local Tempo dealer.

MANUFACTURED IN U.S.A.

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TPL 14-30MHz

TPL Communications offers the most complete line of RF power amplifiers for amateur and commercial applications available.

Two years and 4000 amplifiers have given TPL Communications the experience necessary to produce the finest VHF and UHF amplifiers made for the amateur and commercial market.

TPL presents rf power amplifiers for operation between 14 MHz and 512 MHz with power levels up to 120 Watts.

FOR: SSB AM AND FM
14 to 30 MHz operation

60 Watts output AM
100 Watts output FM
120 Watts output SSB

ILLEGAL FOR CLASS D CITIZENS BAND

TPL 60 TO 120 WATT
POWER AMPLIFIER

ALL SOLID STATE, Absolutely no Tubes!!! **Part No: TPL 5010 and TPL 5010B [bi-linear]**

TPL's "Battery Saver" series of amplifiers are designed to replace the bulky, high battery current TUBE AMPLIFIERS now in amateur and commercial service in the 14 to 30 MHz frequency range. TPL "Battery Saver" amplifiers are completely solid state, never require tuning, once adjusted, and can be operated for hours on an automobile battery without running it down. This is the perfect companion for commercial and amateur solid state transceivers in the 2 to 10 watt class. Power outputs of 100 watts and more are acheived with no more current than some tube amplifiers require for stand by current. This amplifier is truly a dollar per watt bargain, $1.50 per watt of output to be exact, and a real battery saver.

Also available as accessories are a low noise receiver pre-amplifier utilizing a MOS FET transistor, an AC power supply, a control head that measures RF power output, DC voltage and turns the amplifier on and off remotely and a trunk mounting cable kit.

FEATURES:
All Solid State, no tubes to ever replace or shake loose.
Low Stand-by current, typically 5 ma. (a comparable tube amplifier would require 5 to 10 amps)
Low transmit current, typically 12 amps. (a comparable tube amplifier would require 25 to 40 amps.)
Absolutely indestructible; immune to mismatch, over drive and over voltage.
Extremely compact:
No external cooling or ventilation required.
May be mounted anywhere; Trunk, under the seat, etc.
Many Accessories available; Trunk mounting cable kit, remote control/power output monitor, AC power supply and Bi-linear receiving amplifier with MOS-FET transistor.

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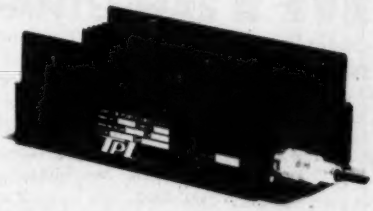
talk power by **TPL** COMMUNICATIONS INC.

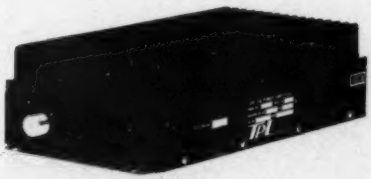
13125 YUKON AVENUE/HAWTHORNE, CALIF. 90250/(213) 679-0131

TPL has a **COMPLETE** *line of RF Power Amplifiers for Six & Two meters and 450 MHz . . .*

TPL 15 to 20W Amp. Give your handheld the punch it needs with as little as 50mw drive.



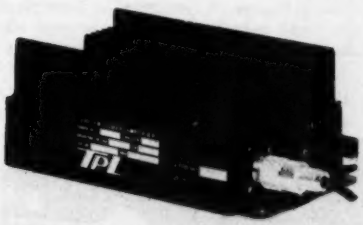
PA3 - 1AE/1AB (2 meters)



TPL 20 to 35W Amp. If your needs are 450, this is your amp. Up to 35 watts or more when driven by your mobile or handheld.

PA61 - AC2/BC2 (450)

TPL 80 to 120W+. If you want the ultimate in power & performance, look no farther. Turn your talkie or transceiver into a booming giant.



PA3 - 1EE/1AE/1DE (2 meters)

TPL REPEATER CONFIGURATION
If repeaters are your thing, TPL has the answer. Order any TPL amp in the repeater configuration. Designed to mount in standard 19" rack. Completely RF shielded with AC supply and forced air cooling.

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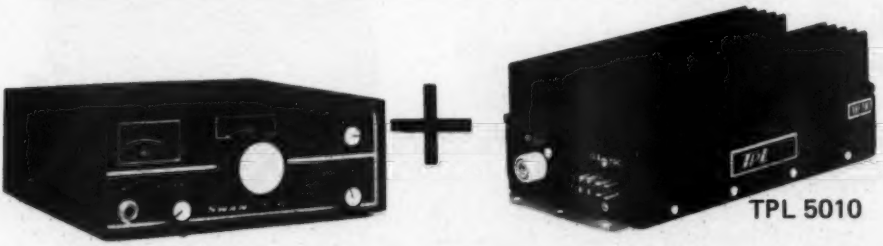
talk power by TPL

We give the best possible deal!

12 VOLT SOLID STATE AMPLIFIERS FOR AMATEUR OPERATION

BAND	PART NUMBER	FREQUENCY	POWER IN	POWER OUT	AMATEUR NET PRICE
6M	TPL 1006	50-54MHz	10Watts	110Watts	$185.00
6M*	TPL 2006	50-54MHz	10Watts	220Watts	$270.00
2M	TPL 152	144-148MHz	1Watt	12Watts	$ 59.00
2M	TPL 302	144-148MHz	1Watt	30Watts	$ 93.00
2M	TPL 502B	144-148MHz	1Watt	50Watts	$130.00
2M	TPL 802B	144-148MHz	1Watt	90Watts	$195.00
2M	TPL 1202B	144-148MHz	1Watt	120Watts	$239.00
2M	TPL 502	144-148MHz	10Watts	45Watts	$113.00
2M	TPL 802	144-148MHz	10Watts	90Watts	$191.00
2M	TPL 1202	144-148MHz	10Watts	120Watts	$228.00
2M*	TPL 2002	144-148MHz	10Watts	200Watts	$375.00
220MHZ*	TPL 401	220-225MHz	10Watts	40Watts	$118.00
220MHz*	TPL 901	220-225MHz	10Watts	90Watts	$175.00
440MHz	TPL 300	420-450MHz	4Watts	25Watts	$162.00
440MHz	TPL 300B	420-450MHz	1Watt	25Watts	$190.00
440MHz	TPL 600	420-450MHz	4Watts	60Watts	$245.00
440MHz	TPL 600B	420-450MHz	1Watt	60Watts	$278.00
10M	TPL 5010	14-30MHz	100Watt FM 150Watt PEP SSB		$169.80
80-10M*	TPL 2001	2-30MHz	400Watts PEP SSB		$395.00

* Available Spring 1974 • • •



Swan MB 40

TPL 5010

20W PEP = 140W PEP OUTPUT

Put a pair of shoes on your new solid state transceiver from Swan on any low power rig between 2 to 30MHz.

TPL carries a complete line of amplifiers up to 400 watts between 2MHz and 516MHz.

A W Electronics

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Cush Craft

2 METER FM ANTENNAS

NEW

FROM THE WORLD'S LEADING MANUFACTURER OF VHF/UHF COMMUNICATION ANTENNAS

(A) FM GAIN RINGO: The most popular — high performance, half-wave FM antennas. Give peak gain, and efficiency, instant assembly and installation.

AR-2	100 watts	135-175 MHz	$14.50
AR-25	500 watts	135-175 MHz	18.50
AR-220	100 watts	220-225 MHz	14.50
AR-450	100 watts	420-470 MHz	14.50
AR-6	100 watts	50-54 MHz	19.50

(B) 4 POLE: A four dipole gain array with mounting booms and coax harness 52 ohm feed, 360° or 180° pattern.

AFM-4D	1000 watts	146-148 MHz	$46.50
AFM-24D	1000 watts	220-225 MHz	44.50
AFM-44D	1000 watts	435-450 MHz	42.50

(C) FM MOBILE: IMPROVED Fiberglass ⅝ wave mobile antenna with new molded base and quick grip trunk mount. Superior strength, power handling and performance.

AM-147T	146-175 MHz mobile	$26.95

(D) POWER PACK: A 22 element, high performance, vertically polarized FM array, complete with all hardware, mounting boom, harness and 2 antennas.

A147-22	1000 watts	146-148 MHz	$56.50

(E) 4-6-11 ELEMENT YAGIS: The standard of comparison in VHF/UHF communications, now cut for 2 meter FM and vertical polarization. 4 & 6 Element models can be tower side mounted.

A147-4	1000 watts	146-148 MHz	$11.95
A147-11	1000 watts	146-148 MHz	19.95
A220-11	1000 watts	220-225 MHz	17.95
A449-6	1000 watts	440-450 MHz	11.95
A449-11	1000 watts	440-450 MHz	15.95

(F) FM TWIST: A Cush Craft exclusive — it's two antennas in one. Horizontal elements cut at 144.5 MHz, vertical elements cut at 147 MHz, two feed lines.

A147-20T	1000 watts	145 & 147 MHz	$39.50

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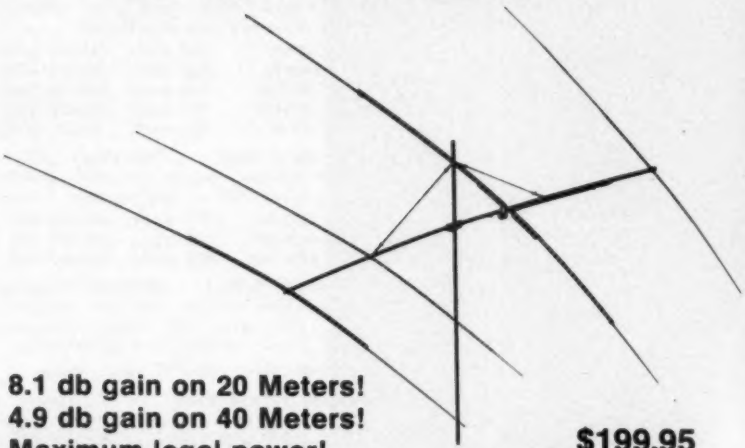
The Most Powerful Antennas Under the Sun

hy-gain

DB-24B

DuoBand Does It Best!

20 AND 40 METERS



8.1 db gain on 20 Meters!
4.9 db gain on 40 Meters!
Maximum legal power!

$199.95

The Hy-Gain DB-24B is the top combination for top performance on 20 and 40 meters. Uses three full-sized elements on 20 meters and two 2/3 size elements in conjunction with Hy-Gain's perfected linear loading on 40 meters. Unique linear decoupling stubs make two band operation possible without inductance and capacity traps. Feeds with 52 ohm coax and is equipped with balun and Beta Match for optimum energy transfer. F/B Ratio: 20 meters, 20-30 db; 40 meters, 10-20 db. Boom length 24 ft., longest element 43 ft., maximum input 1 kw, AM.

DB-24B...*for top duoband performance!*

A W Electronics

491 Riverside Ave.
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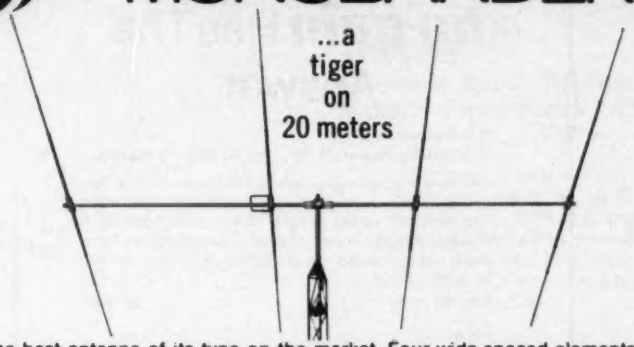
for the most advanced antennas under the sun!

HY-GAIN 204BA MONOBANDER



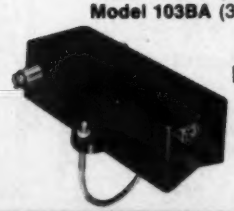
The best antenna of its type on the market. Four wide spaced elements (the longest 36'6") on a 26' boom along with Hy-Gain's exclusive Beta Match produce a high performance DX beam for phone or CW across the entire 20 meter band.

- 10 db forward gain
- 28 db F/B ratio
- Less than 1.05:1 SWR at resonance
- Feeds with 52 ohm coax
- Maximum power input 1 kw AM; 4 kw PEP
- Wind load 99.8 lbs. at 80 MPH
- Surface area 3.9 sq. ft.

The 204BA Monobander is ruggedly built to insure mechanical as well as electrical reliability, yet light enough to mount on a lightweight tower. (Recommended rotator: Hy-Gain's new Roto-Brake 400.) Construction features include taper swaged slotted tubing with full circumference clamps; tiltable cast aluminum boom-to-mast clamp; heavy gauge machine formed element-to-boom brackets; boom 2" OD; mast diameters from 1½" to 2½"; wind survival up to 100 MPH. Shipping weight 51 pounds.

See the best distributor under the sun...the one who handles the Hy-Gain 204BA Monobander.

Model 204BA (4-element, 20 meters)	**$159.95**
Model 203BA (3-element, 20 meters)	**$149.95**
Model 153BA (3-element, 15 meters)	**$ 79.95**
Model 103BA (3-element, 10 meters)	**$ 64.95**



FERRITE BALUN MODEL BN-86

Improves transfer of energy to the antenna; eliminates stray RF; improves pattern and F/B ratio. **$14.95**

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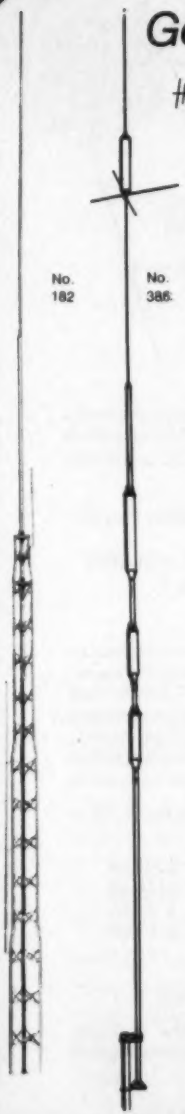
The most powerful signals under the sun!

Got a space problem?

hy-gain Has The Answer



The incomparable
Hy-Gain Hy-Tower 18 Ht. For 80 thru 10 meters.

The finest multi-band omnidirectional vertical antenna on the market today. Entirely self-supporting and virtually indestructible. Takes maximum legal power with ease. Automatic band switching. All hardware iridite treated. *Outstanding performance!* Wt. 96.7 lbs. Ht. 50'
No. 182 **$219.95**

NEW!
Hy-Gain 18 AVT/WB For 80 thru 10 meters.

Superb wide-band omnidirectional performance combined with extra heavy duty construction...for the red-hot action you want. So strong it mounts without guy wires. Automatic switching with three Hy-Q traps. Top loading coil. True 1/4 wave resonance on all bands. *A great buy!* Wt. 16.2 lbs. Ht. 25'
No. 386 **$79.95**

Versatile
Hy-Gain 18 V For 80 thru 10 meters.

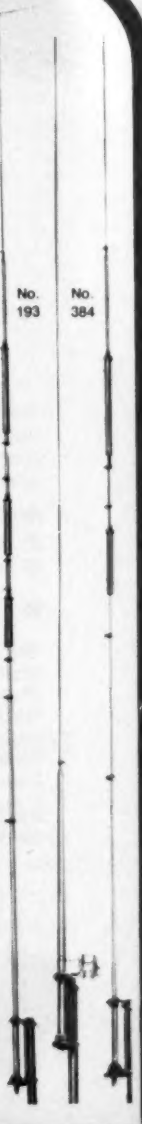
Low cost, high efficiency vertical antenna. Easily tuned to any 80 thru 10 meter band by adjusting feed point on the base inductor. Easily mounted, highly portable. *Installs almost anywhere!* Wt. 5 lbs. Ht. 18'
No. 193 **$24.95**

Hy-Gain
14 AVQ/WB For 40 thru 10 meters

Successor to the famous 14 AVQ...totally improved. Entirely self-supporting, automatic band switching, omnidirectional vertical antenna. Three separate Hy-Q traps with large diameter coils for very high Q. True 1/4 wave resonance on all bands. *Peak performance!* Wt. 9.2 lbs. Ht. 18'
No. 385 **$55.00**

Hy-Gain
12 AVQ For 10, 15 and 20 meters

Low cost, plus performance. Completely self-supporting vertical with Hy-Q traps. Low radiation angle for top performance. *Great antenna for your money!* Wt. 7.2 lbs. Ht. 13'6"
No. 384 **$35.00**



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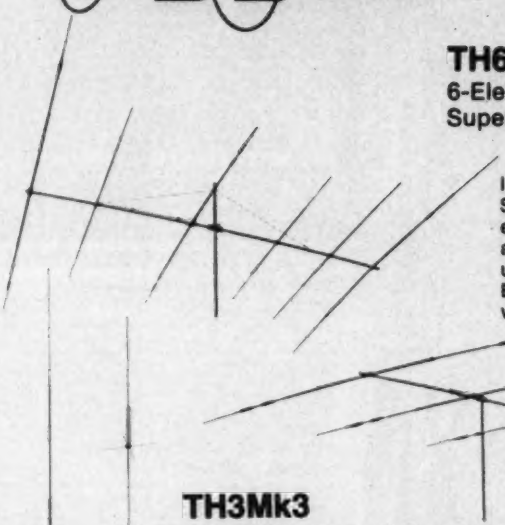
Don't settle for second. Get the best...

hy-gain Antennas!

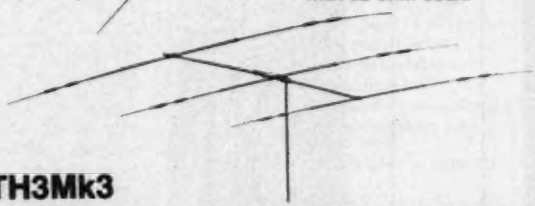


TH6DXX

6-Element Super Thunderbird DX Superior Performance TriBander!

Impressive coverage 10-15-20 meters. Separate, improved Hy-Q trap for each band...SWR less than 1.5 on all bands. Takes maximum legal power, up to 1 kw AM, 2 kw PEP. Exclusive Beta Match. Factory pre-tuned. Feeds with 52 ohm coax.

$189.95



TH3Mk3

3-Element Super Thunderbird Popular TriBand Beam Improved!

Outstanding performance 10-15-20 meters at reasonable cost. Separate, matched Hy-Q traps for each band. Exclusive Beta Match for tapered impedance, DC ground. SWR less than 2:1 at resonance. Accepts maximum legal power and feeds with 52 ohm coax.

$154.95

18AVT/WB

The Great Wide Band Vertical Super Performer 80 through 10 meters!

Superb omnidirectional capabilities. Automatic band switching. Beefed-up Hy-Q traps. Top loading coil. True 1/4 wave resonance on all bands. SWR 2:1 or less at band edges. Outstanding low radiation pattern. Entirely self-supporting.

$79.95

18 HT

Incomparable Hy-Tower Finest Multiband on the Market!

Automatic band selection 80 through 10 meters. Unique stub decoupling system isolates electrical 1/4 wavelengths for each band. Takes maximum legal power. Feeds with 52 ohm coax. 24' tower is entirely self-supporting, virtually indestructible. Requires only 4 sq. ft. for installation.

$219.95

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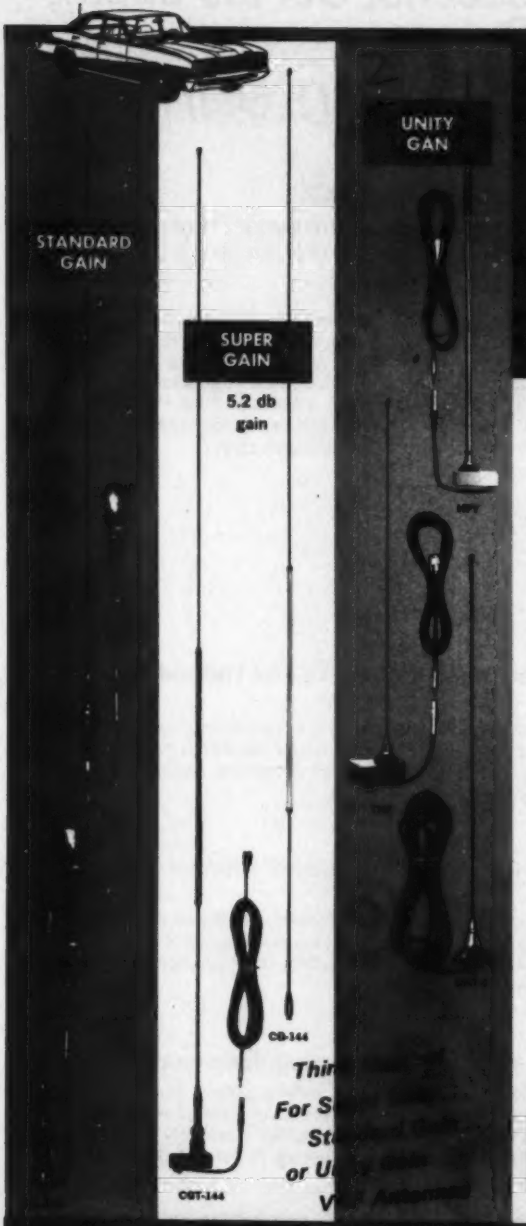

SUPER GAIN MOBILES

TWO METER COLINEAR

MODEL CGT-144 Trunk Lip Mount

5.2 db gain

$36.95

TWO METER COLINEAR— MODEL CG 144

5.2 db gain—Standard mobile base

$24.95

STANDARD GAIN MOBILES

TWO METER 5/8 WAVELENGTH

MODEL BBLT-144 Trunk Lip Mount

• 3.4 db gain • Power rating—200 watts • Length—52"

This trunk lip mount antenna far outsells all other versions. Careful design of the shunt fed matching system guarantees maximum signal radiation at point of lowest SWR; typically 1.1:1 at resonance! Sturdy stainless steel impact spring and extra heavy, tapered 17-7 PH stainless steel radiator for greatest immunity against flutter and detuning at freeway speeds. Trunk lip mount is easy to install on side or edge of trunk lid without drilling and includes 17' RG-58-U, connectors attached, ready for operation. Antenna is removable from mount. Shpg. wt. 2.76 lbs. $32.95

TWO METER 5/8 WAVELENGTH

MODEL BBL-144 Roof Mount

Get the outstanding performance of the Model BBLT-144 in this roof mount version. Mounting assembly is designed for easy and rapid installation in ¾" hole on any flat surface from outside of vehicle. Mechanical performance and R.F. characteristics of the mount are excellent! No wire trimming or soldering required with the 17' RG-58-U and PL-259 included. Antenna may be removed from mount. Shpg. wt. 2.60 lbs. $27.40

UNITY GAIN MOBILES

FOR TWO AND SIX METERS

MODEL HFT Trunk Lip Mount

Get combined two-band operation. Heavy duty four-section telescopic antenna permits separate adjustment for simultaneous resonance on two and six meters. Excellent performance with unity gain (quarter wave) on two and near unity gain on six meters. Operational height approximately 40". Collapses to 22". Antenna is removable from mount. Supplied with easy to install, no drilling, trunk lip mount and 17' RG-58-U with all connectors attached. Shpg. wt. 2.3 lbs. $18.95

VHF-UHF ANTENNA

MODEL THF Trunk Lip Mount

Trimmable 17-7 PH stainless steel radiator is cut to quarter wavelength for unity gain. Performance on any frequency from 140 to 500 MHz. Trim chart included. Easiest of all to install trunk lip mount attaches to rear or side of trunk lid without drilling. Supplied ready for operation with 17' RG-58U, all connectors including PL-259 factory attached. Shpg. wt. 1.5 lbs. $12.95

VHF-UHF ANTENNA

MODEL UHT-1 Roof or Deck Mount

Low profile mount designed for easy installation in ¾" hole on any flat surface or on roof without pulling headliner. Trimmable 17-7 PH stainless steel radiator permits operation on any frequency from 140 to 500 MHz for unity gain (quarter wave) performance. Trim chart and 19' RG-58U included. Shpg. wt. 1.2 lbs. $7.95

ALL

Gain figures are compared to a wave ground plane

Models are field adjustable for lowest SWR

Cable supplied is MIL spec. maximum shield type for superior noise immunity

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VHF

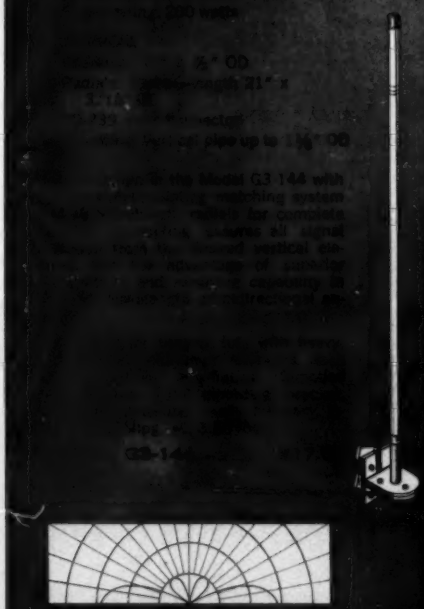
FIXED STATION ANTENNAS

Performance Plus!

The Hustler Model G6-144 omnidirectional colinear has an extremely low angle of radiation achieved through optimum phasing of the ¾ wave and ½ wave radiators. While the Model G6-144 is conservatively rated at 6 db over a quarter wave ground plane, on the air performance checks indicated gains up to 9 db at distances of 20 miles or more. Test comparisons were measured by the EIA substitution method using lab standard attenuators.

Two Meter–5/8 wavelength

6 db GAIN Two Meter Colinear



ELECTRICAL

- 6 db gain over 1/4 wave ground plane
- Omnidirectional radiation pattern
- 50 ohm feed impedance
- Field adjustable
- SWR at resonance—typically 1.1:1
- 6 MHz bandwidth for 1.5:1 or better SWR
- Power rating—250 watts FM

MECHANICAL

- Radiator: 119" x 1"-⅞"-¾" OD high strength aluminum tubing
- Radials: Four—21" x 3/16" OD aluminum rod
- SO-239 coax connector
- Wind load—23 lbs. at 100 mph
- Wind survival—100 mph
- Mounting—cast aluminum flange accepts 1" American standard pipe thread. Shpg. wt. 4.54 lbs.

MODEL G6-144 ..... $39.95

Big signal performance—superior receiving capability—both are yours with the

MODEL G6-144

VERTICAL RADIATION PATTERN—G6-144

A&W Electronics

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Medford, Mass 02155
(617) 396-5550

The "Buck-Buster!"

MODEL SF-2
TWO METER—5/8 wavelength
3.4 db gain over 1/4 wave ground plane

You asked for a mobile gain antenna at reasonable cost. You asked for an antenna easy and quick to install. You asked for an antenna with outstanding performance, reduced signal flutter and optimum SWR and you asked for an antenna that fits your mobile mount or any of the wide selection of Hustler mobile mounts. It's all in the BUCK BUSTER—the two meter gain antenna designed to please even the most discriminating amateur!

SPECIFICATIONS:

- Power rating: 100 watts FM
- Field adjustable for lowest SWR—1.5:1 or better
- 6 MHz bandwidth for 2:1 or better SWR
- Radiating element: 17-7 PH stainless steel—taper ground and polished
- 51" overall length.
- Mounting: 3/8"-24 base fits all standard mobile mounts

MODEL SF-2 ..... **$9.95** (mount not included)
Shpg. wt. 1.87 lbs.

DELUXE MOBILE MOUNTS

Designed for application, performance and appearance and to accommodate any desired location—rain gutter—fender—trunk groove—cowl—trunk lip—deck . . . on any vehicle—foreign or domestic—even the new compacts. **All accept the Buck Buster with 3/8"-24 base.**

TRUNK LIP MOUNT
Easy to install on side or edge of trunk lip without drilling. Includes 17' Mil spec RG-58-U with all connectors factory attached. Shpg. wt. 1.86 lbs.
MODEL TLM **$8.95**

RAIN GUTTER MOUNT
Fits all sizes and any angle rain gutter. Installs without drilling. Includes 180° swivel ball. Shpg. wt. .80 lbs.
MODEL GCM-1 ..... **$5.50**

COWL MOUNT
Low profile mount installs in 1" hole on any flat surface. Includes 180° swivel ball and SO-239 connector. Shpg. wt. .64 lbs.
MODEL MM-1 ..... **$4.50**

TRUNK GROOVE MOUNT
Designed for quick and easy installation in hidden area of trunk groove with hardware supplied. Includes 180° swivel ball. Shpg. wt. .74 lbs.
MODEL TGM-1 ..... **$5.50**

BALL MOUNT
Get economy and performance in this Hustler 180° adjustable swivel ball. Includes rubber pad, steel back-up plate, hardware and hex wrench. Shpg. wt. .84 lbs.
MODEL C-32 ..... **$3.25**

BE AHEAD OF THE ACTION! GET GAIN PERFORMANCE WHERE IT COUNTS . . .

A&W Electronics

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2 METER MOBILE ANTENNAS

3 dB GAIN* VEHICULAR ANTENNAS

MODELS **HM-177 Snap-in Mount**
HM-178 Trunk Mount

Exceptional performance as well as mechanical reliability have made these 3 dB gain vehicular antennas the standard in professional and amateur communication systems for nearly two decades. The shock-resistant, waterproof coils are shunt-fed encased in PVC jackets. New high conductive whips are made of 17-7 PH stainless steel...coated with copper and nickel for high conductivity and greater heat dissipation. All fittings are chrome-plated brass for appearance and long-lasting performance.

HM-177 Suggested Ham Net $29.95
HM-178 Suggested Ham Net $32.95

ELECTRICAL SPECIFICATIONS

Antenna power rating:	Over 100 watts
Frequency range:	144-148 MHz
VSWR:	1.5:1 or better
Nominal input impedance:	50 ohms
Transformer:	DC grounded, shunt-fed PVC jacket-weatherproof, shock resistant. Dia., 1", length, 3-1/2"
*Gain:	3 dB over 1/4 wave whip
Radiation pattern:	Omni-directional (when roof mounted)

MECHANICAL SPECIFICATIONS

Radiator material:	17-7 PH stainless steel, copper and nickel coated
Spring material:	Stainless steel
Base and fittings:	Chrome-plated brass
Cable:	17" type 58/U
Connector:	UHF
Length:	Whip only, max. 47-1/2", full antenna, max. 56"
Antenna connections:	Solderless

Note: Heavy duty version of ASPS177 but tuned for 2 meters

---

3 dB GAIN* HIGH PERFORMANCE VEHICULAR ANTENNA SERIES

MODELS **HM-179 Snap-in Mount**
HM-180 Trunk Mount

All new low profile antennas feature a 5/8 wavelength high conductive whip. Spring and whip may be removed leaving only 1-3/16" high base for minimal car-wash clearance.

Coils are low loss, shock-resistant, directly fed ungrounded configuration and encased in plastic base. New high conductive whips are made of 17-7 PH stainless steel... coated with copper and nickel for high conductivity and greater heat dissipation. Mounts are Teflon®-insulated, aluminum plated steel.

HM-179 Suggested Ham Net $22.95
HM-180 Suggested Ham Net $26.95

ELECTRICAL SPECIFICATIONS

Antenna power rating:	100 watts
Frequency range:	144-148 MHz
VSWR:	1.5:1 or better
Nominal input impedance:	50 ohms
Transformer:	16 AWG copper wire, low loss coil, waterproof cover
*Gain:	3 dB over 1/4 wave whip

MECHANICAL SPECIFICATIONS

Radiator material:	17-7 PH stainless steel, copper and nickel coated
Spring material:	Stainless steel
Base and fittings:	Molded plastic, silver plated contacts
Cable:	17" type 58/U
Connector:	UHF
Length:	54" max., including spring and base
Base coil:	16 AWG copper wire coil, waterproof cover

DURABLE, RUGGED ANTENNA
FOR HAND-HELD PORTABLES

MODEL **HM-4**

A continuously loaded VHF Communication Antenna designed for hand-held portable applications. This antenna will withstand rough handling which destroys telescopics. Can be bent at different angles without destroying its effectiveness. Completely insulated and cannot accidentally be shorted out.

Suggested Ham Net $5.95

ELECTRICAL SPECIFICATIONS

Antenna power rating:	25 watts
Frequency range:	144-148 MHz
Nominal input impedance:	50 ohms, depending upon effective ground plane
Loading coil description:	.050" dia. music wire copper plated

MECHANICAL SPECIFICATIONS

Type mount:	5/16"-32 base which will fit the following portables: Motorola HT units E. F. Johnson
Mounting base dia.:	3/8"
Length:	Approximately 6-1/4"

the antenna specialists co.

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2 METER BASE STATION ANTENNAS

MODEL
HM-172

Suggested Ham Net $29.95

Whether you use a low-powered QRP "lunch-box" rig or the full legal limit, the HM-172 offers 10 dB gain and 4 MHz bandwidth for superior performance under any band conditions. This exceptional bandwidth permits you to QSY at will while VSWR values remain under 1.5:1.

ELECTRICAL SPECIFICATIONS	
Forward gain:	10 dB
Front-to-back ratio:	14 dB
Bandwidth:	4 MHz
Nominal input impedance:	50 ohms
VSWR:	less than 1.5:1
3 dB beamwidth:	50°
Power capability:	2 kW PEP

MECHANICAL SPECIFICATIONS	
Element configuration:	4/4 element stacked yagi
Length:	3' 8"
Width:	3' 4"
Height:	3' 10"
Turning radius:	2' 6"
Weight:	5.8 lbs.
Rated wind velocity:	100 mph

MODEL
HM-173

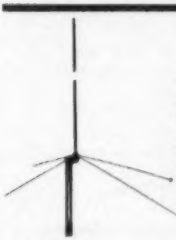
Suggested Ham Net $39.95

Whether your interest lies in local rag-chews, moon-bounce, or meteor scatter, the HM-173 (or several of them stacked) is the solution to long-haul communications with limited power. The unsurpassed gain (13 dB) and 30° (3 dB) beamwidth makes the HM-173 the best antenna for AM or FM 2 meter activity. Covers the entire 2 meter band without tuning.

ELECTRICAL SPECIFICATIONS	
Forward gain:	13 dB
Front-to-back ratio:	16 dB
Bandwidth:	4 MHz
Nominal input impedance:	50 ohms
VSWR:	Less than 1.5:1
3 dB beamwidth:	30°
Power capability:	2 kW PEP

MECHANICAL SPECIFICATIONS	
Element configuration:	8/8 element stacked yagi
Length:	8' 6"
Width:	3' 4"
Height:	3' 10"
Turning radius:	5' 5"
Weight:	9 lbs.
Rated wind velocity:	100 mph

Vertical Mounting Kit for HM-172, HM-173 includes all necessary hardware. HM-185 Suggested Ham Net $7.45



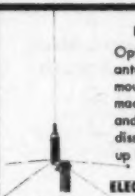
MODEL HM-7A

Budget minded 144, 220, 432 MHz enthusiasts take note: here's a high quality, medium power ground plane antenna that can really withstand abuse. The vertical radiator is chrome plated brass tubing while the radials are removable stainless steel rods (plenty of flexibility to withstand heavy ice loading). Mounting is quick and easy on any mast up to 1-1/4" O.D.

Suggested Ham Net $8.95

ELECTRICAL SPECIFICATIONS	
Nominal input impedance:	50 ohms
Power capability:	100 watts
Gain:	Unity
Bandwidth:	±2 MHz
VSWR:	Less than 1.5:1

MECHANICAL SPECIFICATIONS	
Radiator length:	17-3/4"
Radial length:	26"
Weight:	3 lbs.
Rated wind velocity:	100 mph



MODEL HM-17

Optimum performance at low cost from this half wave antenna. 3dB (Ref. 1/4 wave ground plane). Same quick mounting as HM-7A. New high conductive whips are made of 17-7 PH stainless steel. . .coated with copper and nickel for high conductivity and greater heat dissipation, and stainless steel radials. Mounts on masts up to 1-1/4" O.D.

Suggested Ham Net $29.95

ELECTRICAL SPECIFICATIONS	
Gain:	3 dB (Reference λ/4 ground plane)
Frequency Range:	144-148 MHz (2 meters)
Nominal input impedance:	50 ohms
VSMR:	Less than 1.5:1
Maximum RF Power:	100 watts
Termination:	SO-239, will accept UHF connector
Lighting Protection:	dc ground

MECHANICAL SPECIFICATIONS	
Support:	1-1/4" max. O.D. tubing
Radiating Elements:	Copper and nickel coated
Radials:	Stainless steel
Length:	54" at lowest frequency
Rated Wind Velocity:	100 mph

MODEL ASPA680 "BASE COMMANDER"

Include a lightweight (4 pounds), reasonably priced, fiber glass antenna of the highest quality and durability with your base station installation.

The ASPA680 covers the 146-148 MHz portion of the 2 meter band. Rugged Armorweave™ fiber glass construction assures long reliable service – even in the most hostile environment.

Lightweight construction makes this antenna easy to install, with a heavy-duty heat treated aluminum support mast providing up to 24" of clamping area.

DC grounding of the radiating elements assures maximum protection for equipment.

See Professional Catalog for other Base Station antennas.

Suggested Ham Net $79.50

ELECTRICAL SPECIFICATIONS	
Frequency range:	146-149.5 MHz
Nominal input impedance:	50 ohms
VSWR:	Less than 1.5:1
Bandwidth:	3.5 MHz
Vertical beamwidth:	29°
Maximum RF power:	350 watts
Flexible termination extension:	24" of RG-8A/U with male type "N" connector
Gain:	3 dB minimum (RS-329), 3.55 dB maximum at center frequency

MECHANICAL SPECIFICATIONS	
Support:	1-5/16" O.D. heavy-duty heat treated aluminum tubing
Radiating elements:	3/16" dia. brass tube
Antenna housing:	Armorweave™ fiber glass radome
Mounting:	Heavy-duty mast clamps (not furnished)
Antenna length:	11.4'
Weight:	4 lbs.
Rated wind velocity:	118 mi/h @1.65 safety factor (RS-329)
Lateral thrust:	27.4 lbs (100 mph)
Bending moment:	1170 inch pounds (100 mph)
Projected wind area:	0.996 feet²

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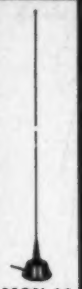
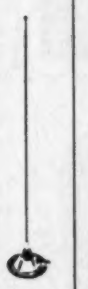
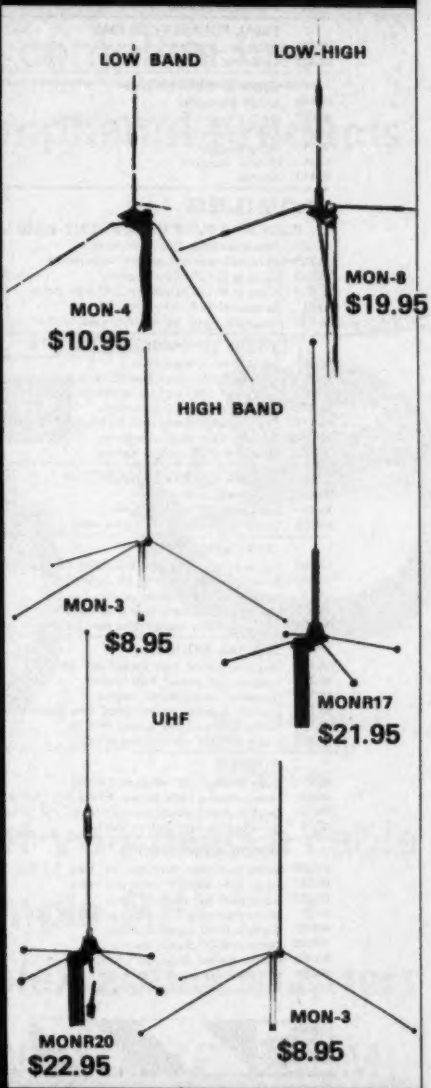
MOBILE

LOW BAND	LOW-HIGH		HIGH-UHF	
				
MON-14 $16.95	MONR6 $15.95	MONR10 $26.95	MON-1 $7.95	MON-2 $13.95
HIGH BAND				
				
MONR16 $21.95	MON-7 $10.95	MON-13 $10.35	MON-9 $13.95	MON-30 $8.95
UHF				
MONR21 $22.95	MONR12 $12.95			

BASE



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BASE STATION

SCANNER BEAM

MS119	Electrically rotated beam, 8.75 dB; omni 5.75 dB	99.95

BEAMS

M-202	3 element, 9.75 dB	39.95
M-201	4 element, 11 dB	44.95
M-134	5 element, 14.5 dB	49.95

DUAL POLARITY BEAMS

M-215	3 element, 9.75 dB	74.95
M-214	4 element, 11 dB	99.95

OMNI-DIRECTIONAL

M-400	5.0 dB Starduster	39.95
M-317	MAG X fiber glass, guaranteed 10 years	59.95
M-227	Mighty Magnum III	36.95
M-117	Super Magnum	32.95
M-81	Original Magnum	25.95
M-417	Polecat	18.95

MOBILES

ROOF OR TRUNK DECK MOUNT - BASE LOADED

M-303	Fiberglass whip, 3/8" hole mount	19.95
M-125	The most used mobile, 3/8" hole mount	17.95
M-123	Same as M-125 without spring	16.95
M-124	Same as M-125 except for 3/4" hole mount	17.95
M-87	Same as M-124 without spring	15.95
M-325	Tunesble center loaded fiber glass, 3/8" mount	19.95

TRUNK LIP QUICK-GRIP MOUNTS

M-410	Big Momma - Heavy Duty	29.95
M-304	Fiber glass whip, base loaded, spring	23.95
M-176	Same as M-125 on trunk lip mount	21.95
M-175	Same as M-176 with no spring	19.95
M-177	Center loaded shorty only 20" high	19.95
MR209	Tunesbl- fiber glass with spring	21.95
MR196	Same as MR 209 without spring	18.95

TRUNK GROOVE MOUNTS

M-127	Base loaded, with spring	20.95
M-73	Same as M-127 without spring	18.95
MR58	Center loaded black fiber glass whip	16.95

COWL MOUNTS

M-103	Center loaded, telescopic whip with AM-FM adaptor	17.95
M-128	Base loaded, with spring, CB only	19.95
M-74	Same as M-128 without spring	17.95
MR52	Center loaded, black fiber glass whip	15.95
MR49	CB only, center loaded telescopic whip	15.95

SPECIAL MOUNTS

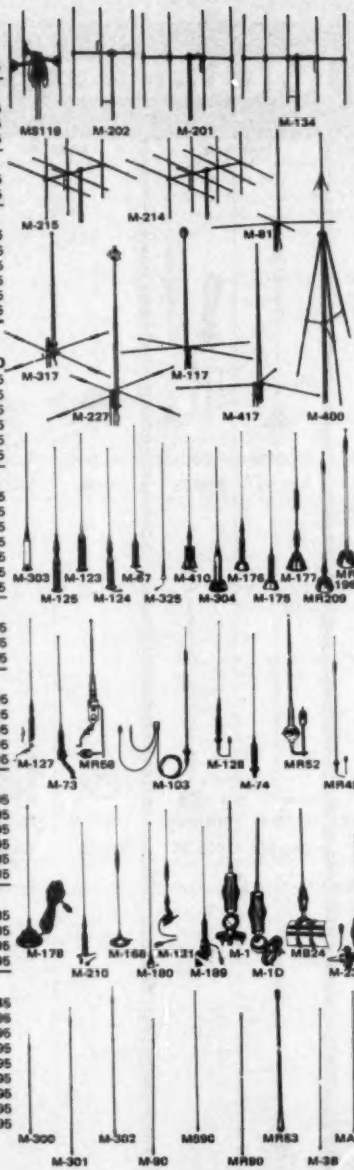
M-178	Magnetic mount, base loaded, 38" whip	17.95
M-210	Luggage rack mount, base loaded	20.95
M-168	Magnetic mount, center loaded	17.95
M-180	FLIPPER, gutter mount, black fiber glass whip	18.95
M-131	Gutter clamp, center loaded only 19"	17.95
M-189	Camper/trailer mount, base loaded	20.95

BUMPER

M-1	Body mount, 102" whip, cad spring	14.85
M-1D	Heavy chrome body mount, spring, 102" whip	17.85
MB24	Double chain bumper mount, spring, 102" whip	21.95
M-23	Same as M-1 with coax connector	19.95

WHIPS, WHIPS, WHIPS

M-300	White fiber glass, tunesble, 38" long, 3/8 stud	11.45
M-301	Same as M-300, 72" long, two piece	14.95
M-302	Same as M-301 except 1 piece	12.95
M-90	White fiber glass full length whip, 3/8" stud	10.95
MB90	Same as M-90 except 2 piece	13.95
MR90	Same as M-90 except black	10.95
MR53	Center loaded, black, 38", 3/8" stud	7.95
M-38	102" stainless steel, 3/8" stud	5.95
MA38	Same as M-38 except 108" long	5.95



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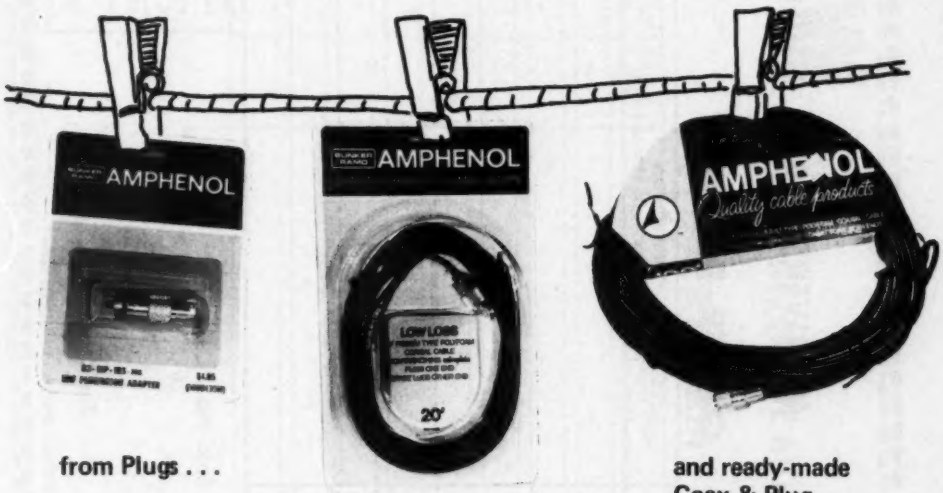
A & W carries a complete line of Amphenol products:



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to Coax . . .

and ready-made Coax & Plug assemblies.

if you need a plug, if you need a cable whether they are simple RF or complex audio adapters

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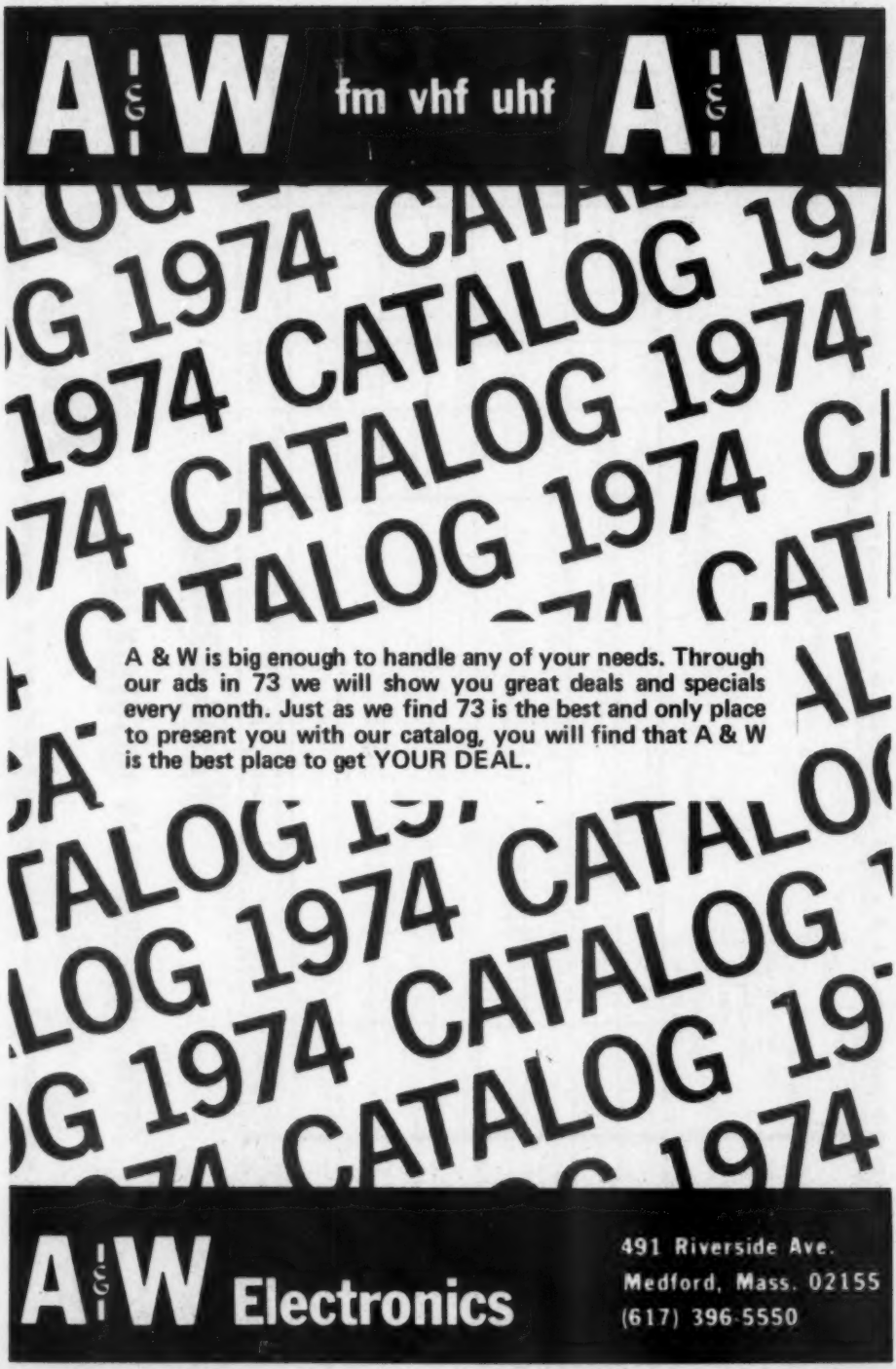
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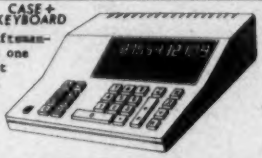
TABLE TOP CALCULATOR — CASE + KEYBOARD



Attractively designed! Excellent craftsmanship. Case and keyboard (designed as one unit). Cabinet is made of high-impact plastic beige color with black bezel and amber window. Keyboard consists of a 3 position slide switch and 25 keys, 5 of which are used for memory function. 20 keys gray, 5 keys orange. All keys mounted on one printed circuit board.

This modular unit is well suited for our calculator chips. Ideal for the CT5005.

Case and Keyboard complete:
ONLY $29.95

3 CHIP CALCULATOR

This calculator set provides all of the electronics for an eight-digit, floating point calculator with left-hand entry. Keyboard, display, clock generator, and display driver is all that need be added to make a calculator that will add, subtract, multiply and divide. Overflow and negative signals are also provided. Complete instructions to build a calculator included.

Chips and data $8.95
Data only (refundable) . 1.00

CT5005 CALCULATOR

This calculator chip has a full four function memory, which is controlled by four keys, +M (adds entry into memory), -M (subtracts entry from memory), CM (clear memory--without clearing rest of registers), RM (read memory or use as entry).

12-digit display and calculate
fixed decimal at 0,1,2,3,4, or 5
leading zero suppression
seven-segment multiplexed output
true credit sign display
single 28-pin chip

Chip and data $14.95
Data only (refundable) . . . 1.00

5001 CALCULATOR

40-pin calculator chip will add, subtract, multiply, and divide. 12-digit display and calculate. Chain calculations. True credit balance sign output. Automatic over flow indication. Fixed decimal point at 0, 2, 3, or 4. Leading zero suppression. Complete data supplied with chip.

Chip and data . . . . . Only $9.95
Data only (refundable). . 1.00

All ICs are new and fully-tested; leads are plated with gold or solder. Orders for $5 or more will be shipped prepaid. Add 35¢ for handling and postage for smaller orders; residents of California add sales tax. IC orders are shipped within 2 workdays of receipt of order--kits are shipped within 10 days of receipt of order. $10.00 minimum on CODs (phone in).

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BABYLON ELECTRONICS

General Telephone KEYBOARD $5.95

Ten push buttons (0-9) programming devices. Easy for panel mounting. Size: 3 x 2¾ x 1"

RECTIFIERS

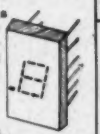
VARO BRIDGES			
V5447	2A	400V	$ .90
V5647	2A	600V	1.10
MR810 Rect.	50V	1A	.10

SCR's

IR122	100V	8AMP	$ .50
IR122	200V	8AMP	.60
IR122	300V	8AMP	.80
IR122	400V	8AMP	1.00

MAN 1

Seven segment, 0-9 plus letters. Snaps in 14-pin DIP socket or Molex. Operates with IC voltage requirements. Long operating life.



ONLY $4.25

7400 SERIES DIP

7400	$ .35	74H51	$ .50
74H00	.50	7453	.35
7401	.35	7454	.35
7402	.30	74L54	.50
74H01	.50	74L55	.50
7403	.35	7460	.35
7404	.35	74L71	.30
74H04	.50	7472	.50
7405	.35	74L72	.60
7406	.75	7473	.65
74H05	.50	74L73	.90
7408	.50	7474	.65
74H08	.50	74L74	.90
7410	.35	74H74	.90
74L10	.50	7475	1.75
74H11	.60	7476	.70
7413	1.75	74L78	1.00
7417	.60	7480	.65
7420	.35	7483	1.30
74L20	.50	7489	4.75
74H20	.50	7490	1.50
74H22	.50	7491	1.15
7430	.35	7492	1.15
74H30	.50	7493	1.15
74L30	.50	7494	1.15
7440	.35	7495	1.25
74H40	.50	74L95	2.00
7441	1.60	74107	.70
7442	1.30	74121	1.60
7446	1.75	74123	2.00
7447	1.75	74154	2.50
7448	1.15	74161	2.50
7450	.35	74163	2.50
74H50	.50	74192	2.50
7451	.35	74193	1.50
74L51	.50	74195	1.10

RCA 2010 NUMITRON

Popular digital display tube. This incandescent 5-volt, 7-segment device provides a .6" high numeral which can be seen from a distance of 30 ft. The tube has a standard 9-pin base (solderable) and a left-hand decimal point.

Each $5.00 SPECIAL 5 for $20.00

LED'S

MV50 red emitting 10-40ms @ 2V — $ .25, 5 for 1.00

MV5024 red TO-18 high dome $ .75, 10 for 6.50

$ .30

MV10B visible red 5-7ms @ 2V — 10 for 2.50

CD-2 COUNTER KIT

This kit provides a highly sophisticated display section module for clocks, counters, or other numerical display needs. The unit is .8" wide and 4 3/8" long. A single 5-volt power source powers both the ICs and the display tube. It can attain typical count rates of up to 30 MHz and also has a lamp test, causing all 7 segments to light. Kit includes a 2-sided (with plated thru holes) fiberglass printed circuit board, a 7490, a 7475, a 7447, a DR 2010 RCS Numitron display tube, complete instructions, and enough Molex pins for the ICs . . NOTE: boards can be supplied in a single panel of up to 10 digits (with all interconnects); therefore, when ordering, please specify whether you want them in single panels or in one multiple digit board. Not specifying will result in shipping delay.

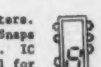
Complete kit, only $11.95
Fully-assembled unit $13.00

Boards can be supplied separately @ $2.00 per digit.

MAN 3M

0-9 plus letters. Right hand decimal point. Flat-pack type case. Long operating life. IC voltage requirements. Ideal for pocket calcualtors!

Each $2.50
Ten or more 1.90 each
W/o decimal 1.50



MAN 4

Seven segment, 0-9 plus letters. Right hand decimal point. Snaps in 14-pin DIP socket or Molex. IC voltage requirements. Ideal for desk or pocket calculators!

Each $2.75
Ten or more 2.50 each

GIANT "NIXIE"

Comes complete with Socket and DD700 202 Numeric Driver. Readability in high ambient light...200 footlamberts brightness!! All DC operation. Long life with no loss of brightness. Compatible with conventional solid state circuitry.

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NE566	function generator TO-5	4.00
NE5556	op amp DIP	1.00
NE5558	dual 741 op amp MINI DIP . . .	1.00
709	popular op amp DIP	.45
710	voltage comparator DIP	.75
711	dual comparator DIP	.40
723	precision voltage regulator DIP	1.00
741	op amp TO-5 MINI DIP	.55
747	dual 741 op amp DIP	1.00
748	op amp TO-5	1.00
CA3045	5NPN transistor array	1.00
LM100	positive DC regulator TO-5 . . .	1.00
LM302	op amp voltage follower TO-5 .	1.25
LM307	op amp	.50
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LM703	RF-IF amp epoxy TO-5	1.00

For the most powerful antennas under the sun

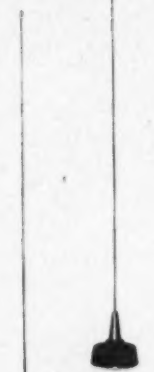
Go all the way into the REPEATER

There's nothing half-way about the new Hy-Gain REPEATER LINE.

Designed for the man who demands professional standards in 2 meter mobile equipment, the REPEATER LINE is the 2 meter HAM's dream come true. It's got everything you need for top performance...toughness, efficiency and the muscle to gain access to distant repeaters with ease. Reaches more stations, fixed or mobile, direct, without a repeater.

The right antennas for the new FM transceivers ...or any 2 meter mobile rig.

Rugged, high riding mobiles. Ready to go where you go, take what you dish out...and deliver every bit of performance your rig is capable of.



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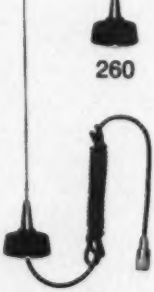


261

262

260 Commercial duty 1/4 wave, claw mounted roof top whip. Precision tunable to any discrete frequency 108 thru 470 MHz. 17-7 ph stainless steel whip.

261 Same as above. Furnished complete with 18' of coax and connector.

262 Rugged, magnetic mount whip. 108 thru 470 MHz. Great for temporary or semi-permanent no-hole installation. Complete with coax and connector. Base matching coil for 52 ohm match. 17-7 ph stainless steel whip.

2 meter mobile! with LINE from hy-gain

263 Special no-hole trunk lip mount. 3 db gain. 130 thru 174 MHz. 5/8 wave. Complete with 16' coax. Operates at DC ground. Base matching coil for 52 ohm match. 17-7 ph stainless steel whip.

264 High efficiency, vertically polarized omnidirectional roof top whip. 3 db gain. Perfect 52 ohm match provided by base matching coil with DC ground. Coax and connector furnished.

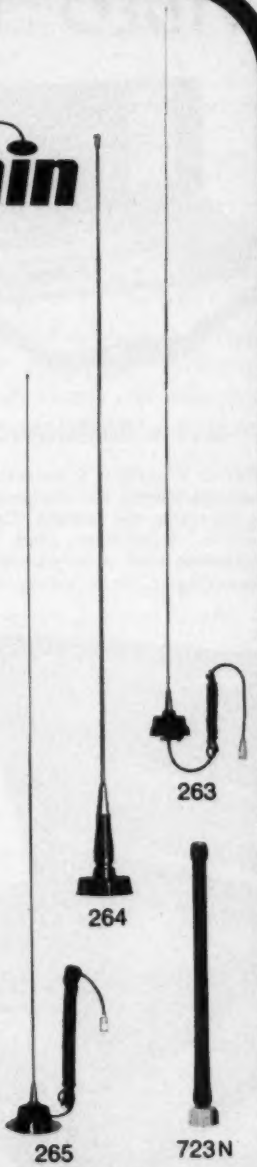
265 Special magnetic mount. 3 db gain. Performance equal to permanent mounts. Holds at 90 mph plus. 12' of coax and connector. Base matching coil for 52 ohm match. 17-7 ph stainless steel whip. DC ground.

Rugged, durable, continuously loaded flexible VHF portable antennas. Completely insulated with vinyl coating. Bend at all angles without cracking or breaking. Cannot be accidentally shorted out.

723N With UHF connector.

269 With 5/16-32 base for Motorola HT; Johnson; RCA Personalfone; Federal Sign & Signal; and certain KAAR, Aerotron, Comco and Repco units.

723A With BNC connector.



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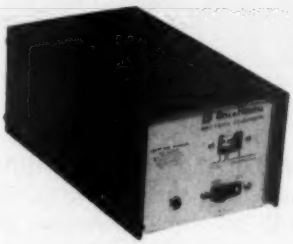
VIDEO TAPE RECORDERS



BELL & HOWELL MODEL 2965

This is a portable system and comes with recorder, camera and charger. A TV monitor is built into the recorder. Camera includes built-in Microphone and Zoom lens. Recording time is 20 minutes on 5" tape. Recording is both video and audio.

SPECIFICATIONS

RECORDER:

Built-in 2:1 EIA Sync Generator
AGC: Audio & Video
RESOLUTION: 525 lines, HOR. RESOLUTION: 300 lines
AUDIO RESPONSE: 80-10,000 Hz
POWER REQUIREMENTS: 12V DC, 10 watts
BATTERIES: 2/3G x 3/U Rechargeable (not included)
CHARGER: Model 105905 included

CAMERA:

RESOLUTION: 525 lines, HOR. RESOLUTION: 500 lines
VERT. FREQ: 60 Hz (EIA)
HOR. FREQ: 15,750 Hz (EIA)
VIDEO OUTPUT: 1.0 p-p, 75 ohm, unbalanced
MIN. ILLUMINATION: 30 lux.
VIEWFINDER: 1½" (1" CRT w/magnifier)
LENS: 5:1 zoom F2 – 22
SHIPPING WT. 35 lbs.

LIST: $1595

***OUR PRICE* (NEW) $550.00**

BELL & HOWELL Model 2966 – SHIBADEN SV700UC

(Assemble, Edit and Stop Motion)

This video recorder will record directly from a standard TV set or a TV camera. It will play back over your home TV set. Audio may be dubbed onto the tape. A 7" reel (2400') will record 1 hr. No home VTR unit under $1000 can match the quality and capabilities of this unit.

SPECIFICATIONS

RESOLUTION: 525 lines, Standard TV or CCTV recording
VIDEO: Input and output: 1.0V p-p, 75 ohms, unbalanced. Greater than 3.5 MHz freq. response. 300 lines plus Hor. resolution.
AUDIO: Mike or line inputs. 80-10,000 Hz freq. range
POWER REQUIREMENTS: 110V AC, 95 watts
DIMENSIONS: 18 3/8" W x 10 3/16" H x 15 11/16" D
AGC or Manual Audio & Video gain
POWER REQUIREMENTS: 110V AC, 95 watts
WEIGHT: 65 lbs.

LIST PRICE (1972) $995.00

***OUR PRICE* (NEW) $450.00**

(USED) $250.00

Experimenter's Special $100.00

MAINTAINANCE MANUAL $5.00

ORDER BLANK

Please rush _____ Bell & Howell model/s 2966_____Bell & Howell model/s 2965

_____Rolls, Video Tape_____Batteries_____Color Adapters

Price_____

to: Name_____

Shipping_____

Address_____

Total _____

City_____State_____ZIP_____

RECHARGEABLE BATTERIES – New, for Porta Pak . **$36.00** a set.

COLOR ADAPTERS – limited number available, will work with almost any Black and White VTR to convert to NTSC color, record-playback-does not impair monochrome use. **$450.00** ea. prepaid.

NEW NAME BRAND VIDEO TAPES – 2400 ft. (1 hr.) any quantity available, shipping wt. 2 lbs. **$29.00** each.
1200 ft. (½ hr.) **$19.00** each.

CONDITIONS OF SALE:

NEW EQUIPMENT – sold new. Guaranteed 90 days. Replaced or repaired by us, if found defective upon arrival.

USED EQUIPMENT – sold *as is* in good working order. NO warranty. All units checked prior to shipment.

EXPERIMENTER'S DELIGHT – used *as is* repairable. Physically intact not beat to hell, but requiring some work. Problems and probable causes listed with each machine.

PARTS – available at near giveaway prices, through us.

SERVICE – units can be serviced by any competent video technician, as well as through Bell & Howell AV Service and Shibaden in Melrose Park, Illinois.

QUANTITY DISCOUNT – on orders of more than 10 machines.

DEALER INQUIRIES – are invited for sale of new equipment.

New machines have standard Japan EIA 8P connector to mate with all popular VTR monitors. Used machines have all coax and cannon xl connectors. Used machines do not have AGC or edit ability, but are otherwise identical and interchangeable.

All sales are final. Cash with order. Shipped best way. Freight charges collect.

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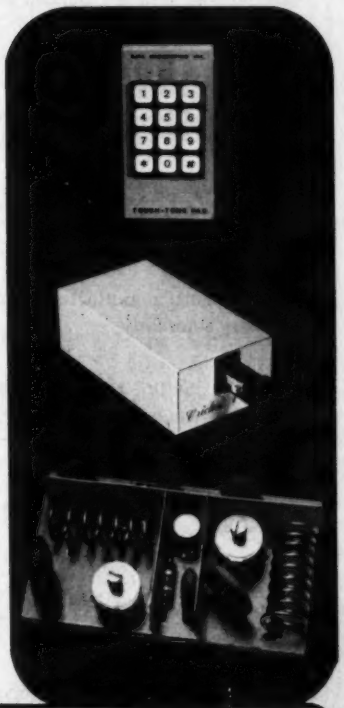

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More features than any other pad including built-in monitor speaker and latest Phase-Lock loop circuitry.

- TTP-1 Standard pad for portable transceiver mounting.
- TTP-2 Standard pad in attractive case for home or mobile use.
- TTP-3 Mini-pad in attractive case for home or mobile use.
- TTP-4 Mini-pad for portable transceiver mounting.

TTP-1, 2, 3 & 4, Sh. wt. 1 lb. $44.50
TTP-1K, 2K, 3K & 4K, Sh. wt. 1 lb. $34.50

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Specially made for both OLD and NEW receivers. The smallest and most powerful preamp available. Provides 20dB gain at 2.5 N.F. to bring in the weakest signals.

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- Lowest AM detection level of any comparable unit (including many commercial rigs)
- Power: the GTX-2 and GTX-200 boast 30 watts nom. output
- Lightweight: manufactured to aviation industry standards
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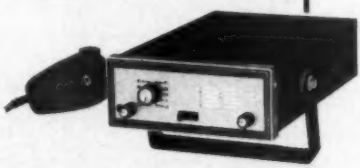
- ¼" phone jack included as standard (GTX-2 and GTX-200)

GTX-200 **$269.95***

(30 watts output power, nom., up to 100 channel combinations)

GTX-2 **$259.95***

(30 watts output power, nom., accommodates 10 channels)



GTX-10 **$209.95***

(10 watts output power, nom., accommodates 10 channels)

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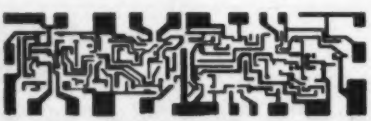

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3925		10		300	4.10
3950		70		150	26.20
4072		.35		550	1.50
4073		1.5		550	1.80
5109		2.5		1200	2.20
5179		200MC		1400	.59
5583		1		1300	4.90
5589		3		175	4.75
5590		10		175	7.25
5591		25		175	16.90
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5862		90		175	50.00
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MSC80256	5.00	3

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MM595	1
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MM624	1
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2N3821	N-Channel J Fet	1.25
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2N3896		35	3.18	
2N4204	800	100	Pulse Modulator	65.50
TI4042	200	7	1.50	

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			MFC9011	
			MFC9020	2 Watt Audio Amplifier 2.00

MC1526G	Darlington Input Differential Amplifier	60.00
MC1530G	Operational Amplifier	12.75
MC1531G	Operational Amplifier	12.75
MC1533G	Operational Amplifier	5.25
MC1539G	Dual Operational Amplifier	12.75
MC1537L	Operational Amplifier	4.90
MC1545L	Wideband Amplifier	8.25
MC1545G	Wideband Amplifier	8.25
MC1552G	Video Amplifier	9.00
MC1554G	1 Watt Power Amplifier	14.25
MC1556G	Operational Amplifier	18.00
MC1558L	Operational Amplifier	7.50
MC1590G	Wideband Amplifier With AGC	5.60
MC1710CP	Differential Comparator	.72
MC1710G	Differential Comparator	2.65
MC1711L	Dual Differential Comparator	2.65
MC1741G	Operational Amplifier	5.85

S & R Enterprises

MC1302P		
MC1303L	Dual Stereo Preamplifier	2.20
MC1304P	FM Multiplex Stereo Demodulator	2.00
MC1305P	FM Multiplex Stereo Demodulator	2.00
MC1306P	Half Watt Audio Amplifier	.88
MC1307P	FM Multiplex Stereo Demodulator	1.30
MC1310P	Stereo Demodulator	4.10
MC1316P		
MC1328P	Dual Doubly Balanced Chroma Demodulator	1.70
MC1350P	IF Amplifier	.95
MC1355P	Limiting FM IF Amplifier	1.40
MC1430G	Operational Amplifier	5.25
MC1431G	Operational Amplifier	5.25
MC1431P	Operational Amplifier	5.25
MC1435P	Dual Operational Amplifier	2.25
MC1439G	Operational Amplifier	2.20
MC1440G	Core-Memory Sense Amplifier	1.50
MC1520G	Operational Amplifier	9.75
MC1524G		

7400 Series TTL

7400	Quad 2 Input Nand Gate	.60
7401	Quad 2 Input Nand Gate O.C.OP	.60
7402	Quad 2 Input Nor Gate	.60
7403	Quad Nand Gate O.C.	.60
7404	Hex Inverter	.75
7405	Hex Inverter O.C.	.60
7406	Hex Inverter Buffer Driver O.C.	.85
7407	Hex Buffer Driver O.C.	.85
7408	Quad 2 Input And Gate	.75
7409	Quad 2 Input And Gate O.C.	.75
7410	Triple 3 Input Nand Gate	.60
7411	Triple 3 Input And Gate	.60
7413	Dual Nand Schmitt Trigger	1.50
7416	Hex Inverter Buffer Driver O.C. High Voltage Output	1.90
7417	Hex Buffer Driver O.C. High Voltage Output	2.00
7420	Dual 4 Input Positive Nand Gate	.60
7423	Expandable Dual 4 Input Positive Nor Gate With Strobe	1.50
7425	Dual 4 Input Positive Nor Gates With Strobe	.75
7427	Triple 3 Input Positive Nor Gate	1.50
7430	8 Input Positive Nand Gate	.60
7432	Quadruple 2 Input Positive Or Gate	.75
7437	Quadruple 2 Input Positive Nand Buffer	1.50
7438	Quadruple 2 Input Positive Nand Buffer	1.50
7440	Dual 4 Input Positive Nand Buffer	.60
7441	BCD To Decimal Decoder/Driver	2.00
7442	BCD To Decimal Decoder	1.50
7445	BCD To Decimal Decoder/Driver O.C. High Voltage Output	2.00
7447	BCD To Seven Segment Decoder/Driver	2.00
7448	BCD To Seven Segment Decoder/Driver	2.00
7450	Expandable Dual 2 Wide 2 Input And Or Invert Gate	.60
7451	" " " " "	.60
7453	4 Wide 2 Input And Or Invert Gate	.60
7454	4 Wide 2 Input And Or Invert Gate	1.00

These Devices Are All Prime Units.
Some Are In Limited Quantity Order As Soon As Possible

74179	4 Bit Parallel Access Shift Registers	5.00
74180	8Bit Odd/Even Parity Generator/Checker	3.00
74181	High Speed Arithmetic Logic	5.00
74182	Look Ahead Carry Generator	2.00
74190	Synchronous Decade Up/Down Counter With Preset Inputs	3.00
74193	Synchronous 4 Bit Binary Up/Down Counter With Preset Inputs	3.00
5400	Quad 2 Input Nand Gate	3.10
5401	Quad 2 Input Nand Gate O.C.,SP	3.10
5402	Quad 2 Input Nor Gate	3.10
5410	Triple 3 Input Nand Gate	3.10
5442	BCD To Decimal Decoder	13.20
5445	BCD To BDC Decoder/Driver	23.95
5447	BCD To Seven Segment Decoders/Drivers O.C.,SP	20.00
5470	J-K Flip-Flop	4.60
5474	Dual D Type Positive Edge Triggered Flip-Flop W/Preset & Clear	6.00
54121	Monostable Multivibrators	6.15
54151	Dual 2 Wide 2 Input And Or Invert Gate	3.10
7400	Quad 2 Input Nand Gate	1.00
7404	Hex Inverter	1.00
7403	Quad Nand Gate O.C.	1.00
7406	Hex Inverter	1.50
7474	Dual D Type Positive Edge Triggered Flip-Flop W/Preset & Clear	2.00
74175	Quadruple D Type Flip-Flops	2.00
7400	Quad 2 Input Nand Gate	.75
7401	Quad 2 Input Nand Gate O.C.,SP	.75
7404	Hex Inverter	1.50
7405	Hex Inverter O.C.	1.50
7410	Triple 3 Input Nand Gate	1.00
7411	Triple 3 Input Positive And Gate	1.00
7420	Dual 4 Input Nand Gate	1.00
7430	8 Input Nand Gate	1.50
7440	Dual 4 Input Nand Gate	1.50
7451	Dual 2 Wide 2 Input AOI Gate	1.50
7452	Expandable 4 Wide And Or Gates	1.50

7460	Dual 4 Input Expander	.60
7472	J-K Master Slave Flip-Flop	1.50
7473	Dual J-K Master Slave Flip-Flop	1.50
7474	Dual D Type Edge Triggered Flip-Flop	1.50
7475	Quadruple Bistable Latch	1.50
7476	Dual J-K Master Slave Flip-Flop With Preset & Clear	2.00
7479		2.00
7482	2 Bit Binary Full Adders	3.00
7483	4 Bit Binary Full Adder(Look Ahead Carry)	2.50
7485	4 Bit Magnitude Comparators	2.00
7486	Quad 2 Input Exclusive Or Gate	2.00
7490	Decade Counter	2.00
7491	8 Bit Shift Register	2.00
7492	Divide By 12 Counter(Divide By 2 & Divide By 6)	2.00
7493	4 Bit Binary Counter	2.00
7495	4 Bit Right Shift Left Shift Register	2.00
7496	5 Bit Shift Register	2.00
74100	4 Bit Bistable Latch	4.00
74105	Gated J-K Master Slave Flip-Flop	1.00
74107	Dual J-K Master Slave Flip-Flop	1.00
74121	Monostable Multivibrator	2.00
74122	Retriggerable Monostable Multivibrator With Clear	2.00
74145	BCD To Decimal Decoder/Driver	3.00
74150	16 Line To 1 Line Data Selector/Multiplexer	4.00
74151	8 Line To 1 Line Data Selector/Multiplexer	2.50
74153	Dual 4 Line To 1 Line Data Selector/Multiplexer	2.50
74154	4 Line To 16 Line Decoder/Demultiplexer	5.00
74155	Dual 2 Line To 4 Line Decoders/Demultiplexer	2.50
74157	Quadruple 2 Input Data Selector/Multiplexer	2.50
74160	Synchronous 4 Bit Counter	5.00
74161	Synchronous 4 Bit Counter	5.00
74163	Synchronous 4 Bit Counter	5.00
74164	8 Bit Parallel Out Serial Shift Register	4.00
74165	Parallel Load 8 Bit Shift Register	4.50
74170	4 X 4 Register File	5.00
74175	Quadruple D Type Edge Triggered Flip-Flop	5.00

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S & R Enterprises

1344 EAST INDIAN SCHOOL ROAD/PHOENIX, ARIZONA 85014/(602) 277-2712

BANKAMERICARD

ANOTHER SELECTRONIC SPECIAL
The R648/ARR 41 Receiver

Can be best described as a mini version of the R390A rec, and has most of the key features of the 390A

Digital readout 500 kHz to 24.999 MHz
1.4 kHz to 6 kHz mechanical filters
500 kHz to if, Double conversion
Xtal calibrator, 500 ohm output
17 tubes
8" x 17" x 12" – Weight: 34 pounds

Receiver has been tested, overhauled, and guaranteed. **Excellent condition Price: $175.00**

We have a few receivers with AC power supply installed. **Price: $199.50**

SPECIAL – We have a few R648 receivers left to be sold as is – physically complete, repairable $99.50

R508 VHF Rec. 118-148 MHz
Price: $14.95 ea.

R.F. AMPLIFIERS

TUNES 50 to 100 mhz – COMPACT ALL ALUM. CASE 12" x 15" x 6¼" WITH SK 600 EIMAC SOCKET. 1 LARGE AIR VARIABLE CAP. – 2 SMALL AIR VARIABLE TRIMMERS – TEFLON MOUNTED ROTARY INDUCTOR – GOOD FOR LINEAR AMPLIFIER – CAN USE EITHER 4 CX150A or 4 CX250 – LESS TUBE, PRICE: ....$14.95 ea.
WITH 4 X150A, PRICE: .....$19.95 ea.

ADJUSTABLE PRINTED CARD BOX
For Rack Mount
5" to 7¼" – 16 slides and sockets – includes 30 double contact position edge connector type
Price: $9.95 ea.

Solid State 866A Direct Replacement
Price: $5.95 ea. or 2/$10.00

WINTRONIX MODEL 850 INDUCED WAVE-FORM ANALYZER. This unit, in conjunction with your present oscilloscope, permits you to view wave forms in the range from audio thru MHz without any direct connection. The probe is simply placed over the tube in question and the wave form is displayed on the oscilloscope. It may also be used as a high gain amplifier to increase scope sensitivity. Excellent for TV, radio, amplifier, and transmitter repair and maintenance. Brand new, with probe.
SHIP WT. 13 lbs. Price: $19.95 ea.

MODULE TYPE POWER SUPPLY TRANSISTOR, REGULATED.
115V – 60 cycle in +12 –12 –6V @ 3 amp output. Front Panel adj + or –10%. On-off switch. Fuses. Barrier strip output. 6" x 5" x 7". Excellent Cond.
Ship. Wt. 10# Price: $14.95 ea.

Small B5031, No boards with sockets, 4/$5.00.

DIGITAL READOUT SET

Make your own counter, frequency meter, digital voltmeter, readouts, etc.
Kit includes
6 nixies with 6 sockets
1 transformer
1 P/S board w/socket
PRICE: .....$12.95, 2/$20.00

MODERN ALUMINUM BENCH RACK CABINET
11½" H x 18" D x 19" W. 8" panel openings w/rubber feet and disappearing handle.
Lt Blue Price: $7.95 ea.

TRIAD TRANSFORMERS
F22A 6.3 VCT at 20 AMPS **$5.95 each**
F21A 6.3 VCT at 10 AMPS **$3.95 each**

Lighted panel mount switches 2 PDT, 5/8" hole, uses midget flanged type bulb **$1.00 each, 6/$5.00**

Receiver R-36/GR 225-400 MHz. Crystal Control Double conversion FM with squelch and noise limiter. 600 ohms output. 115-230 Volts, 50-60 cps. Price: $24.95

Coaxial relays, single pole - double throw, available in UHF,BNC, Type N. Specify.
Price:$4.95 each.

Quality precision polished plate glass 2.200" by 9.540" by .250".
Price: 4 pc/$1.00, 25 pc/$5.00

Adapters BNC to SO-239. Price: 2/$1.00.

Lighted switches 2 pdt push pole panel mount 5/8" hold.
$1.00 each, 6/$5.00

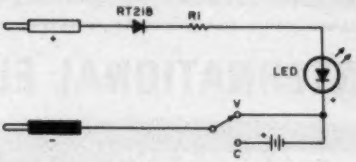
Triad transformers F-21A 115 Volts 60 cycles 6.3 VCT at 10 Amps.
Price: $4.95.

Transmitter, 110 W FM, 406–420 Mc. Rack mount, with power supply.
Price: $150.00

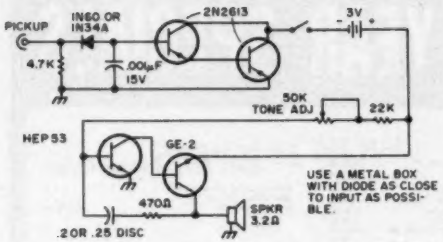
ALL PRICES ARE F.O.B. OUR WAREHOUSE, PHILADELPHIA, PA. ALL MERCHANDISE DESCRIBED ACCURATELY TO THE BEST OF OUR KNOWLEDGE. YOUR PURCHASE MONEY REFUNDED IF NOT SATISFIED. TERMS ARE CASH. MIN. ORDER $5.00. ALL MERCHANDISE SUBJECT TO PRIOR SALE. RFE – REMOVED FROM EQUIPMENT.

SELECTRONICS
1206 South Napa Street
Philadelphia, PA 19146
215-468-7891 215-468-4645

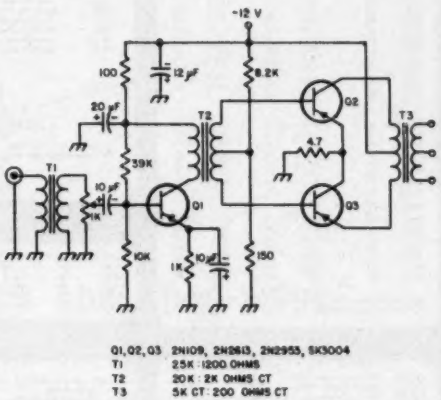
MORE CIRCUITS . . .

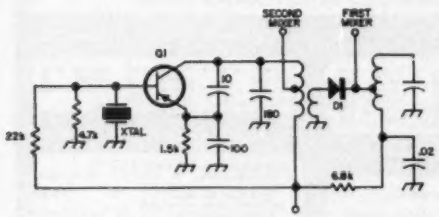


A LED continuity and voltage tester, when the switch is in the V position the presence of a voltage and its polarity is indicated The C position converts the unit into a continuity checker. R1=470Ω, LED=ED150 or ED155 and the battery is a 9V transistor type. Thanks to Sprague Products Co.



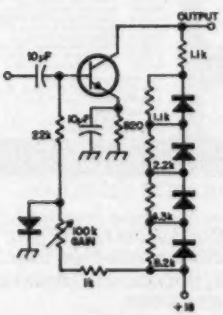
A wireless CW monitor that needs only to be placed near a source of rf to operate. Thanks to WA3SWS.

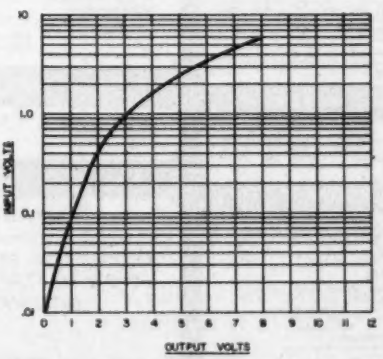




Single oscillator and diode provide two injection frequencies for dual conversion receivers. Transistor Q1 is a GE-9 or HEP-2 the diodes should be a 1N82A or similar.

This 100 mW modulator may be used to collector modulate transmitters up to about 200 mW or to base modulate somewhat larger power amplifiers. Good performance with a minimum of components is obtained by transformer coupling between stages.





This simple dynamic range compressor provides more than 50 dB range; it exhibits gain with a 20 millivolt signal but will not saturate with input voltages up to 6 or 7 volts. All the diodes are IN914; transistor Q1 should be a SK3010 GE-8 or HEP-54.

INTERNATIONAL ELECTRONICS UNLIMITED

TTL

7400	$ .25	7446	$1.45	74122	$ .95
7401	.25	7447	1.45	74123	1.15
7402	.25	7448	1.50	74136	.95
7403	.25	7450	.29	74145	1.25
7404	.29	7451	.32	74150	1.25
7405	.27	7453	.32	74151	1.05
7406	.59	7454	.45	74153	1.45
7407	.53	7460	.32	74154	1.75
7408	.29	7465	.30	74156	1.29
7409	.29	7481	.90	74157	1.50
7410	.25	7484	.45	74157	1.50
7411	.39	7485	.45	74161	1.69
7413	.55	7470	.50	74163	1.69
7416	.59	7472	.49	74164	2.95
7417	.59	7473	.55	74165	2.95
7420	.25	7474	.55	74166	1.95
7421	.32	7475	.55	74173	1.95
7422	.39	7476	.55	74175	1.95
7423	.37	7479	.89	74176	.95
7425	.39	7483	1.25	74177	.95
7426	.39	7486	1.20	74180	1.15
7427	.39	7488	.55	74181	4.25
7430	.25	7489	3.50	74182	1.15
7432	.30	7491	1.25	74190	1.69
7437	.32	7492	1.49	74192	1.69
7438	.39	7493	1.05	74193	1.69
7440	.25	7494	1.05	74194	1.69
7441	1.25	7495	1.10	74195	1.15
7442	1.15	7496	1.09	74196	1.25
7443	1.25	7497	1.05	74197	1.15
7444	1.30	74100	1.40	74198	2.50
7445	1.35	74121	.55	74199	2.50

Low Power TTL

74L00	$ .40	74L42	$1.75	74L95	$1.25
74L02	.40	74L45	1.45	74L96	.95
74L03	.40	74L51	.40	74L90	1.75
74L04	.40	74L71	.60	74L91	1.50
74L08	.40	74L72	.60	74L93	1.75
74L10	.40	74L73	.60	74L95	1.75
74L20	.40	74L74	.60	74L164	2.95
74L30	.40	74L78	.60		

8000 Series TTL

8004	$ .45	8123	$1.75	8570	$2.95
8005	.35	8182	1.75	8650	1.15
8091	.69	8214	1.95	8810	.95
8093	.59	8220	2.95	8812	1.35
8094	.59	8260	.95	8822	2.95
8095	.63	8262	1.05	8830	.69
8122	1.95	8520	1.45	8831	2.95

ALL DIP PRICE.

Specify spec. sheets required with order. Add $ .50 per spec sheet for items less than $1.00 ea.

Linear

LM 300	Pos V Reg (super 723)	TO5	$ .95 ea.
LM 301	Hi performance AMPL	TO5	.49 ea.
LM 302	Voltage Follower	TO5	.95 ea.
LM 304	Negative Voltage Regulator	TO5	1.25 ea.
LM 305	Positive Voltage Regulator	TO5	1.25 ea.
LM 307	Op AMP (super 741)	TO5	.49 ea.
LM 308	Micro Power Op Amp	TO5	1.25 ea.
LM 309H	5 V Regulator	TO5	1.25 ea.
LM309K	5 V 1A Regulator	TO5	1.95 ea.
LM 310	Voltage Follower Op Amp	TO5	1.45 ea.
LM 311	Hi Perf. Voltage Comp.	TO5	1.25 ea.
LM 320	-5.2 V Negative Regulator	TO3	1.95 ea.
LM 320	-12 V Negative Regulator	TO3	1.95 ea.
LM 320	-15 V Negative Regulator	TO3	1.95 ea.
LM 370	AGC/Squelch Amp	DIP	1.39 ea.
LM 372	AF - IF Strip-Amplifier	DIP	.89 ea.
LM 373	Pos Voltage Regulator	DIP	.65 ea.
LM 380	2 watt Audio Amplifier	DIP	1.75 ea.
LM 395	Precision Voltage Regulator	DIP	.95 ea.
LM 709	Op Amp	TO5 or DIP	10/$3.50 .39 ea.
LM 723	Voltage Regulator	TO5 or DIP	6/$3.50 .79 ea.
LM 741	Comp. Op Amp	TO5 or DIP	10/$3.50 .49 ea.
LM 747	Dual 741 Op Amp	TO5 or DIP	4/$3.50 .95 ea.
LM 3900	Quad Amplifier	DIP	.59 ea.
LM 75451	Dual Peripheral Driver	DIP	.39 ea.
LM 75452	Dual Peripheral Driver	DIP	.49 ea.

Specify TO5 or Dip Package

Specify spec. sheets required with order. Add $ .50 per spec sheet for items less than $1.00 ea.

Phase Locked Loops

NE 565	Phase locked loop	TO5 or DIP	$3.95 ea.
NE 566	Function Generator	TO5 or DIP	3.95 ea.
NE 567	PLL/TONE Gen.	TO5 or DIP	3.95 ea.

Memories

1101	256 bit RAM MOS (2501)	62.50 ea.
1103	1024 bit RAM MOS	7.95 ea.
7489	64 bit RAM TTL	3.50 ea.
8223	Programmable ROM	6.95 ea.

*** NEW ITEM ***

MM 5240 — 1024 bit RAM (based on 1103 . . . Featuring 16 pin DIP rather than 18 pin . . . 30% less power consumption . . . Introductory Price . . . . 9.95 ea.

NEW YEAR SPECIALS

1101	256 Bit RAM MOS 2501	$2.50 ea.
8223	Programmable ROM	5.95 ea.
LM309K	5V 1A Regulator	1.79 ea.
8001	Retriggerable One Shot	.55 ea.
LS75451	Dual Peripheral Driver	.39 ea.
7437	Quad 2-In NAND Buffer	3/$1.00
7438	Quad 2-In NAND Buffer	3/$1.00
7453	Expandable AND-OR-INVERT gate	4/$1.00
7490	Decade counter	1.10 ea.
74121	One Shot (monostable multivibrator)	.39 ea.
74193	Up/down binary counter	1.39 ea.

5002 LSI Calculator Chip

Factory powered version of 5001 with 12 MAN 3M LED

Complete with Data $10.95/set

MM5312 Digital Clock Chip

28 pin - any readout - 6 digit BCD with 4 MAN 3M LED

Complete with Data $11.95/set

MOS Grab Bag

5 Untested MOS MIX (dip) . . . . . $ 2.00

50 Untested MOS MIX (dip) $10.00

5001 LSI Calculator Chip

Overclocked on this popular calculator chip. This month only . . . With Data . . . . . $ 4.95 ea.

NEW YEAR SPECIALS IN EFFECT THROUGH JANUARY

CMOS

74C00	$ .65	74C73	$1.70	74C161	$3.25
74C02	.65	74C74	1.60	74C162	3.25
74C04	1.10	74C76	1.70	74C163	3.25
74C10	.65	74C107	1.50	74C192	3.25
74C20	.65	74C157	2.25	74C195	3.65
74C42	2.15	74C160	3.20	80C97	1.50

4000 Series — RCA Equivalent

CD 4001	$ .45	CD 4011	$ .45	CD 4030	$ .55
CD 4002	.45	CD 4012	.45	CD 4035	.85
CD 4009	1.50	CD 4016	1.50	CD 4050	3.95
CD 4010	.95	CD 4023	.95		

Calculator Chips

8001 LSI (40 pin) Add, subtract, multiply & divide 12 digit
Data supplied with chip . . . . . $6.95 ea.
Data only-Refundable w/purchase . . . . . 1.00 ea.

5002 LSI Similar to 8001 except designed for battery power
Data supplied with chip . . . . . $6.95 ea.
Data only-Refundable w/purchase . . . . . 1.00 ea.

5005 LSI (28 pin) Full four function memory, 12 digit display and calc. 7 segment multiplexed output
Data supplied with chip $10.95
Data only-Refundable w/purchase . . . . . 1.00 ea.

Digital clock . . . on a Chip

MM 5311 (28 pin) Any readout 6 digit BCD with spec. sheet . . . . . $11.95 ea.

MM 5312 (24 pin) Any readout 4 digit (pm BCD with spec. sheet . . . . . 8.95 ea.

MM 5313 (28 pin) Any readout 6 digit (pm BCD with spec. sheet . . . . . 10.95 ea.

MM 5314 (24 pin) LED-Transformer readout 6 digit with spec sheet . . . . . 10.95 ea.

MM 5316 (40 pin) Normal alarm, snooze alarm, sleep timer 12 or 24 hr. operation with spec. sheet . . . . . 15.95 ea.

LED

MV5026 Visible red SUPER SPECIAL . . . . . $ .25 ea.
MV50 type red panel . . . . . .25 ea. 3/$1.00
MV5020 type Lamp red . . . . . .35 ea. 3/$1.00
MS6 baby red TO18 . . . . . .69 ea.
MAN 1 The original . . . . . 3.50 ea.
MAN 2 type . . . . . 1.00 ea. 3 or more 1.49 ea.
MAN 4 type . . . . . 2.75 ea. 3 or more 2.50 ea.
Data-Lite 707 (MAN 1 repl) . . . . . 2.95 ea.

Opto Isolators

MCA 2-30	Darlington	$ .95 ea.
MCD 2	Diodes	1.95 ea.
MCT 2	Transistor	1.49 ea.

UNTESTED SECONDS

MM502	Dual 20-bit dynamic shift register	TO5 $ .39 ea.
MM503	Dual 50-bit dynamic shift register	TO5 .39 ea.
MM504	Dual 10-bit static shift register	TO5 .39 ea.
MM505	Dual 32-bit static shift register	TO5 .39 ea.
MM506	Dual 100-bit shift register	TO5 .39 ea.
MM507	Dual 64-bit accumulator	TO5 .39 ea.
MM5010	512 bit dynamic shift register	TO5-DIP .39 ea.
MM5013	1024 bit dynamic shift register/memory	TO5-DIP .59 ea.
MM5010	Dual 256 bit mask prog. shift register	TO5 .39 ea.
MM5011	Dual 32-bit static shift register	TO5 .39 ea.
MM5063	Dual 100-bit static shift register	TO5 .39 ea.
MM5034	Dual 64/72/80-bit static shift register	DIP .39 ea.
MM5230	2048-bit read only memory	DIP 1.00 ea.
MM5240	2048-bit Auto interrupt generator	DIP 1.00 ea.
MM1402	1024 bit dynamic shift register	DIP .59 ea.
MM1404	1024-bit dynamic shift register	DIP .59 ea.

MOS Shift Registers — 2000 Series

2002 2006 2009 2010 2011 2019 2020 2021 2022

Untested economic 4/1.00

Grab Bag Specials
15 Assorted TTL's (dips) $1.00/bag
25 Assorted DTL's (dips) $1.00/bag

Memories

1101	256 bit RAM MOS (2501)	62.50 ea.
1103	1024 bit RAM MOS	7.95 ea.
7489	64 bit RAM TTL	3.50 ea.
8223	Programmable ROM	6.95 ea.

*** NEW ITEM ***

MM 5240 — 1024 bit RAM (based on 1103 . . . Featuring 16 pin DIP rather than 18 pin . . . 30% less power consumption . . . Introductory Price . . . . 9.95 ea.

ON ORDERS OVER $25.00 DEDUCT 10%

Satisfaction guaranteed. All items except as noted are fully tested. Minimum order $5.00 prepaid in U.S. and Canada. Calif. residents add sales tax. Orders filled within three days from receipt.

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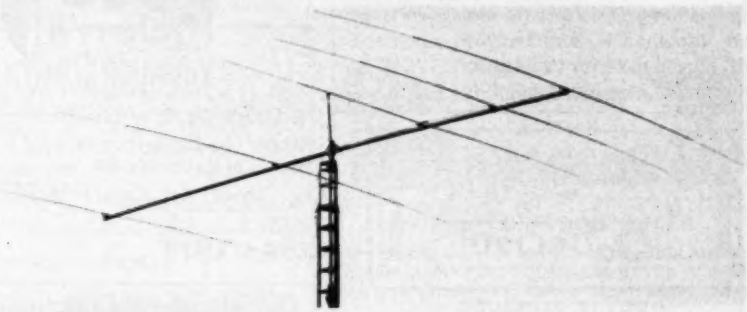
KLM ELECTRONICS...
Introduces the "Big Stick"

Available NOW . . . at only $199.95*



talk softly, but carry the "Big Stick"

A NEW 5 ELEMENT MONOBANDER FOR THE SERIOUS 20 METER DXer.

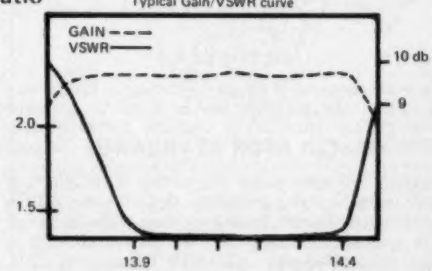
We've designed this antenna with two, ultra high-effeciency driven elements for . . .

- Taking the full legal power limit and loving it.
- Constant gain (9.7 + .2 dbd and flat VSWR from 13.9 to 14.4 MHz.
- 30 db front to back ratio.
- Greater than 35 db front to side ratio
- No retuning for phone and CW.
- BOOM: 3" dia. 41 ft long.
- WEIGHT: 65 lbs.

Order now direct from KLM or see your local dealer. Dealer inquiries are invited. Write for our complete amateur line catalog.

Like we've been telling you . . . we're "The Communications Equipment Innovators".

Typical Gain/VSWR curve



*KLM 4:1 4KW PEP balun optional at $13.95

KLM ELECTRONICS

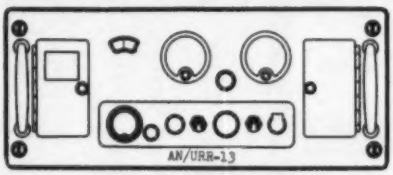
1600 Decker • San Martin, California 95046 (408) 683-4240 and (408) 842-7349

RT-70/GRC **$20 each, 3/$50**

Latest government release. Transmitter-Receiver RT-70/GRC covers 47 to 58.4 mc FM. Requires only 90 Volts dc and 6 volts dc. Used, visually OK, supplied with schematic.

1 MC crystal used for calibration $4.00

116 page maintenance manual for GRC $2.00



URR–13 RECEIVER

Listen in to jet planes, Air Force 1, U-2 spy planes, FBI, etc. They use the frequency covered by this receiver . . . 220 to 400 mc. Possibilities of covering the 220-450 mc band by re-tuning. Operates from regular 115 Volt 60 cycle, requires only antenna and speaker. Tuneable through the frequency, direct reading dial. Schematic and write up on this set furnished.

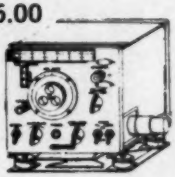
Visually OK condition ... URR-13 - $50.00

CALCULATOR KEYBOARD

A nice purchase by us due to contract termination. Brand new, 2 styles available, one for use with Gen. Inst. C-500 chip, another for use with Cal-Tex 5001 and 5002 chips or Mostek 5010 and 5012 chips. Measure approx. 2.6 x 3.7 inches.

Calculator Keyboard - $8.00 (either one), any 2 for $15.00

LM FREQ METER $35.00



Lowest price yet. W/tubes, crystal and original calibration book. Look OK but unchecked. Typical schematic furnished. 8 lbs. .....#LM 35.00

TCS RCVR or XMTR

Used, look good, with schematic, receiver or transmitter. Frequency range 1.5 to 12 MC. Three bands, VFO or crystal, voice and CW. These sets Collins design, becoming scarce.

RCVR or XMTR $35.00

RCA INJECTION LASER DIODES

Another SUPER SCOOP by Meshna. Brand new RCA packaged, considered obsolete by RCA but what an exotic opto-electronic device for the sophisticated experimenter. Only several hundred on hand. Values shown are approx. as each diode characteristic varies. Each is marked with correct value.

6 WATT $10.00

10 WATT $15.00

RCA TD-XI TUNNEL DIODE

Original packaged, each factory marked, with spec sheet.

$1.25 each, 5/$5.00.

15 AMP BATTERY CHARGER

Brand new GE transformer, 25 amp fullwave bridge. Output approximately 15 volts up to 15 amps. Ideal battery charger or DC source for general use. With instructions , assembled in minutes.

PK–4 **$7.50**

Meshna

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Brand new keyboards for hand held calculators. Two styles available. One for CAL TEX 5001–5002–5012 or MOSTEK 5010–5012. Another for use with GEN INSTR C500.

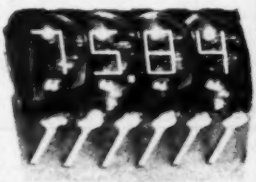
$8.00 each, 2/$15.00

CT 5005 CALCULATOR ON A CHIP

Single MOS chip with all logic required for 12 digit 4 function desk top calculator with extra storage register for memory or constant. Multiplexed 7 segment outputs for LED, Incandescent, Fluorescent or Gas Discharge displays. Brand new and bargain priced. With Specs.

$8.00 each, 2/$15.00

HP LED DISPLAYS



Brand new 4-on-strip LED display. End butt two strips and come up with 8 digit readout. An unheard of SUPER VALUE at $8.00 per strip of 4 digits. Two strips (8 digits) $15.00. Another strip . . . this one a clock readout. The strip has 2 digits . . . space . . . 2 digits. Perfect for reading hours & minutes.

$8.00 per strip, 2/$15.00

CMOS 4814 HEX INVERTER

DIP with operation 3–18 Volts. Dual diode protection against static charge destruction. Dielectrically isolated complimentary MOS.

$1.00 each, 12/$10.00

DUAL 16 BIT MEMORY

Serial MOS by PHILCO in TO–5 case. Brand new with 2 page specs.

#PLR 532 **$1.00 each, 12/$1.00**

PHONE PATCH KIT

Includes all parts, instructions, cabinet.

AM PATCH – $5.00 **SSB PATCH – $9.00**

2048 BIT MOS MEMORY

MOS LSI random access memory #NEC 6003. All inputs except clock are TTL compatible. 2048 word by 1 bit. 22 pin ceramic DIP. With specs.

$9.00 each, 2/$17.00

VOLTAGE CONTROLLED OSCILLATOR

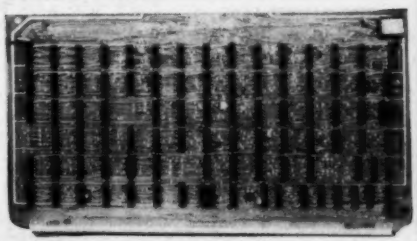
Rare item. See Pop. Elect. Mag. Oct. 1973 for uses. In 14 pin DIP package.

#8038C **$9.95 each, 2/$18.00**

ASCII KEYBOARDS W/ENCODER

From Raytheon, new or like new. 5 extra function buttons each side. Open faced, no cabinet. Schematic provided. Price is postpaid world wide.

$46.00



7400 SERIES ICs

Talk about bargains . . . this is a whopper. Due to quantity on hand, we are reducing this item to a new MESHNA MESHU GINA deal. About 100 devices, all marked and easily removed. With shrinking supplies and upward direction of prices, this makes it well worth going into the salvage business. This Super Mother Board can be stolen for $6.00 each or 6 for $25.00. We also have these in ST 600 series DTL. So give your choice . . . 7400 series or ST 600 series. Mix-N-Match if you wish.

#SAN **$6.00 each, 6/$25.00**

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RGS ELECTRONICS

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7401	.25	7442	1.10	74107	.60
7402	.25	7446	1.35	74121	.60
7403	.25	7447	1.25	74122	.60
7404	.30	7448	1.25	74123	1.10
7405	.30	7450	.25	74125	.65
7406	.50	7451	.25	74126	.65
7407	.50	7453	.25	74141	1.25
7408	.30	7454	.25	74151	1.10
7409	.30	7473	.50	74153	1.40
7410	.25	7474	.50	74154	1.70
7411	.30	7475	1.00	74157	1.40
7413	.85	7476	.65	74164	2.00
7416	.50	7483	1.25	74165	2.00
7417	.50	7486	.50	74166	2.00
7420	.25	7489	3.25	74181	4.50
7430	.25	7490	1.00	74192	1.75
7432	.30	7492	1.00	74193	1.50
7437	.50	7493	.80	74195	1.15
7438	.50	7495	1.00	74200	9.00

7 SEGMENT DISPLAYS

MAN3 $2.00 4/$6.00
com. cat., .125 in. high
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MISSING SEGMENT/NO DECIMAL POINT
(take your chances; no choice)
MAN3 $.25
MAN4 .50

DISCRETE RED LEDS	1–9	10+
MV10 TO-18	$.25	.20
MV50 tiny	.35	.30
MV5024 diffused bright red lens	.35	.30
clear lens, fisheye	.50	
DISCRETE COLORED LEDS	.50	
MV1 amber	.50	
MV5020 type, amber	.75	.70
MV2 TO-18 green	1.00	
MV5222 green	2.00	
MV5322 yellow		

JUNCTION FETs, TO-18 case

N-CHANNEL:	SIMILAR TO:	
NJF10	2N4416, MPF102	3/$1.00
NJF11	2N4091-93	4/$1.00
NJF12	2N4338-41	4/$1.00
NJF13	2N3089	3/$1.00
NJF14	2N4221-22	4/$1.00
P-CHANNEL:		
PJF11	2N3382-86	4/$1.00
PJF14	2N2608	4/$1.00

All FETs come with data sheets.

TRANSISTORS

NPN TO-18 general purpose
silicon .15
10 or more, .10
PNP TO-18 general purpose
silicon .15
10 or more, .10
2N2222 (NPN) TO-18 .25
10 or more, .20
2N2907 (PNP) TO-18 .25
10 or more, .20

UNTESTED DTL

All marked units, dual in-line packages. 20/$1.00

POWER SUPPLY KIT PS 5-1

5 volt 1 amp regulated power supply kit with p.c. board and instructions. Board measures 2"x6"; completed kit is 2" high. Transformer has internal r.f. shield.
$10.00

WIRE WRAP SOCKETS

14 pin	$ .50
16 pin	.60
24 pin	1.25
28 pin	1.35
40 pin	1.80
wire-wrap socket pins	.05
100 or more,	.04

LEDS

LED 10R – Pack of 10 discrete red lens LEDs, various MV5020-series types. $1.50
LED 10C – Pack of 10 discrete clear lens LEDs, various MV5020-series types. $1.50
Application note included.

RECTIFIERS & DIODES

1amp 50PIV silicon rectifier			$ .10
3amp 400PIV silicon rectifier			.25
FB50 lamp 50PIV bridge rectifier			.60
40429 triac 4amp 200PIV, brand new			1.00
	1–9	10–99	100+
1N914, brand new	$.10	.07	.05

MEMORIES

MM1101	256-bit static RAM	$2.25
MM5260	1024-bit dynamic RAM	8.00

¼ WATT RESISTORS

all values listed are $.05; 10 or more, .04
We have: 150Ω, 2.2K, 2.7K, 10K, 12K, 18K, 47K, 220K
Please specify how many you want and of which values.

RGS ELECTRONICS (408) 247-0158
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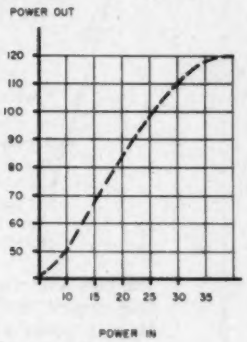
We sell many ICs and components not listed in this ad. Send a stamp for our free flyer. TERMS OF SALE: All orders prepaid; we pay postage. $1.00 handling charge on orders under $10.00. California residents add 5% sales tax. Please include name, address and zip code on all orders and flyer requests.

NEW 2 METER POWER BOOSTER

- 110 watts PLUS with your Clegg 27
- 80 watts PLUS with your Regency

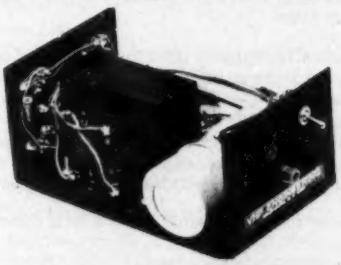
PA 110/30 – $149.95, wired and tested



SOLID STATE

24 AMP REGULATED SUPPLY

10 – 15 volts 3% regulation



50 mV ripple 24 AMP maximum out

Complete kit less cover (chassis included) **only $69.95**
Also available PS–3 card only **$ 8.95**

COMING ATTRACTIONS . . .

2W . . . 2 Channels

Well Under $100

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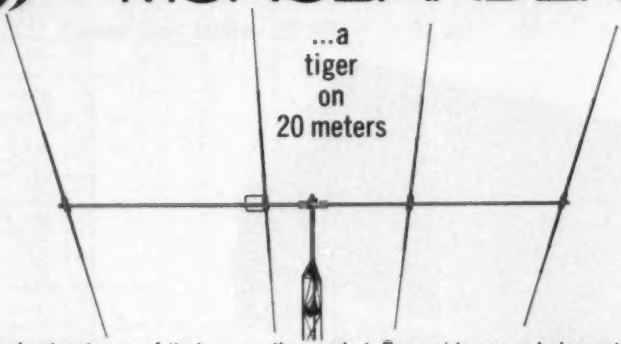
for the most advanced antennas under the sun!

HY-GAIN 204BA MONOBANDER



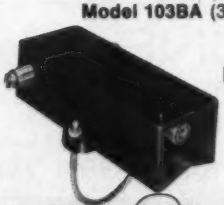
The best antenna of its type on the market. Four wide spaced elements (the longest 36'6") on a 26' boom along with Hy-Gain's exclusive Beta Match produce a high performance DX beam for phone or CW across the entire 20 meter band.

- 10 db forward gain
- 28 db F/B ratio
- Less than 1.05:1 SWR at resonance
- Feeds with 52 ohm coax
- Maximum power input 1 kw AM; 4 kw PEP
- Wind load 99.8 lbs. at 80 MPH
- Surface area 3.9 sq. ft.

The 204BA Monobander is ruggedly built to insure mechanical as well as electrical reliability, yet light enough to mount on a lightweight tower. (Recommended rotator: Hy-Gain's new Roto-Brake 400.) Construction features include taper swaged slotted tubing with full circumference clamps; tiltable cast aluminum boom-to-mast clamp; heavy gauge machine formed element-to-boom brackets; boom 2" OD; mast diameters from 1½" to 2½"; wind survival up to 100 MPH. Shipping weight 51 pounds.

See the best distributor under the sun...the one who handles the Hy-Gain 204BA Monobander.

Model 204BA (4-element, 20 meters).....**$159.95**
Model 203BA (3-element, 20 meters).....**$149.95**
Model 153BA (3-element, 15 meters).....**$ 79.95**
Model 103BA (3-element, 10 meters).....**$ 64.95**



FERRITE BALUN MODEL BN-86

Improves transfer of energy to the antenna; eliminates stray RF; improves pattern and F/B ratio. **$14.95**

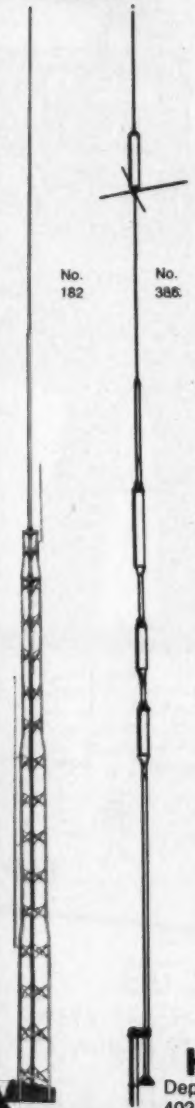
hy-gain **ELECTRONICS CORPORATION**
Dept. CA, 8601 Northeast Highway Six, Lincoln, NE 68507
402/464-9151 Telex 48-6424
Distributed in Canada by: LECTRON RADIO SALES, LTD. 211 Hunter Street West, Peterborough, Ontario

The most powerful signals under the sun!

Got a space problem?

hy-gain Has The Answer

Even if you're limited to just a few square feet of real estate, you've got room for a Hy-Gain multi-band vertical antenna. Unquestionably the ultimate in strength and performance...occupies minimum ground space. Whatever your requirements...*you can't do better than Hy-Gain.*



No. 182

No. 386

The incomparable
Hy-Gain Hy-Tower 18 Ht. For 80 thru 10 meters.

The finest multi-band omnidirectional vertical antenna on the market today. Entirely self-supporting and virtually indestructible. Takes maximum legal power with ease. Automatic band switching. All hardware iridite treated. *Outstanding performance!* Wt. 96.7 lbs. Ht. 50'
No. 182 **$219.95**

NEW!
Hy-Gain 18 AVT/WB For 80 thru 10 meters.

Superb wide-band omnidirectional performance combined with extra heavy duty construction...for the red-hot action you want. So strong it mounts without guy wires. Automatic switching with three Hy-Q traps. Top loading coil. True 1/4 wave resonance on all bands. *A great buy!* Wt. 16.2 lbs. Ht. 25'
No. 386 **$79.95**

Versatile
Hy-Gain 18 V For 80 thru 10 meters.

Low cost, high efficiency vertical antenna. Easily tuned to any 80 thru 10 meter band by adjusting feed point on the base inductor. Easily mounted, highly portable. *Installs almost anywhere!* Wt. 5 lbs. Ht. 18'
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Hy-Gain
14 AVQ/WB For 40 thru 10 meters

Successor to the famous 14 AVQ...totally improved. Entirely self-supporting, automatic band switching, omnidirectional vertical antenna. Three separate Hy-Q traps with large diameter coils for very high Q. True 1/4 wave resonance on all bands. *Peak performance!* Wt. 9.2 lbs. Ht. 18'
No. 385 **$55.00**

Hy-Gain
12 AVQ For 10, 15 and 20 meters

Low cost, plus performance. Completely self-supporting vertical with Hy-Q traps. Low radiation angle for top performance. *Great antenna for your money!* Wt. 7.2 lbs. Ht. 13'6"
No. 384 **$35.00**

No. 385 No. 193 No. 384

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UT–1

Portable Tune Up Meter with cables to plug into Motorola, Link, GE, Standard, etc. This unit gives you the meter functions of the radio being tested. It also operates as a portable dc voltmeter with the following full scale ranges: 1.5, 5, 15, 50, 150, 500, 1 KV with a special 3 volt range for GE Progress Line equipment. The UT-1 can be set zero center for discriminator readings. Also featured in the UT-1 is a field strength meter. Place your order now. Kit form **$42.50**. Wired **$49.95**. Extra cables of your choice (specify rig) . **$5.00 ea.**

($2.00 for postage and handling.)

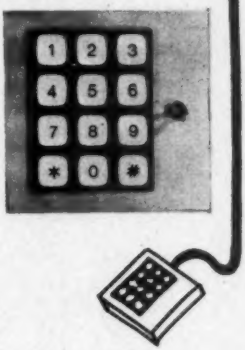
TESCO–PAD

The "TESCO–PAD" has no tuned coils to go off frequency, no tuning necessary or even there! It's all in one "Black Box I.C." ready to go. The "TESCO–PAD" has a 1 second hold-up for your transmitter, complete P.T.T. operation, available with dual audio output levels, 12 or 16 tone combinations.

KIT $34.95 **$39.95 Wired**

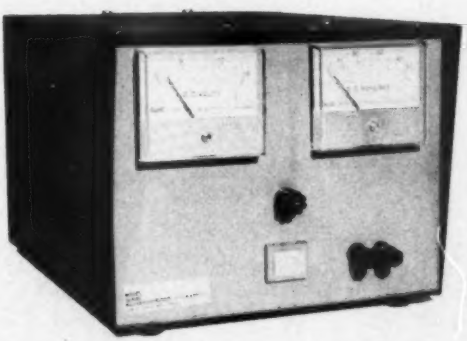
(Add $1.00 for 16 tone version)
($2.00 for dual output version)

Add $1.00 for postage and handling.)



THE ULTIMATE IN 12V POWER SUPPLIES . . . . .

- Tabletop size – 10¼"w by 8"h by 13" long
- 60 A @ slightly less than 12 Vdc
- Nominal Output: 50 A at 12 Vdc
- Voltage and current metering built-in
- Will run a mobile rig & even an amplifier from 110 Vac



$100 KIT

$125 WIRED

Shipped freight collect – 47 lbs.

ORDER NOW – PRICE INCREASE COMING IN EARLY 1974

Waller Electronics - Test Equipment Sales

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JUGE

Sony VideoRover® II

Battery Operated Video Tape Recorder/ Video Camera

A completely portable, battery-operated VTR system, easily operated by one person. The camera weighs only 6 lbs, includes a 6 to 1 zoom lens and built-in Electret condenser microphone. Both audio and video levels are AGC controlled for fully automatic operation. A built-in one inch TV picture tube serves both as an electronic viewfinder and screen for playing back recorded scenes immediately. No special lighting is required as the camera operates over a range of 30 to 10,000 foot-candles, adequate for most indoor shooting.

The Videocorder records picture and sound from the camera, or off the air with a TV monitor. It uses ½ inch video tape which conforms to E1AU-1 standard. Horizontal resolution is more than 300 lines. The AC adapter charges the battery and operates the VideoRover on AC. Special features of the Videocorder include stop action and audio dubbing (you may add audio after recording of video to replace the original audio). Reording time is 30 minutes per reel of tape. The recorder weighs 18 lbs., 12 oz. The VideoRover II comes with camera, zoom lens, battery pack, AC adapter, tape and reel, and carrying case. **$1745.00**

V-30H 30 minute tapes, 1210 feet, 5 1/8" diam. reel	**$20.00**
DC-2400 car battery cord with cig. lighter plug	**$21.05**
RFU-RF ADAPTER required to play back through any home TV set. Actually a miniature TV transmitter, available on channels 2, 3, 4, 5, 6, or 7. Mounts inside Videocorder.	**$59.40**

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DALLAS, TEX 75229

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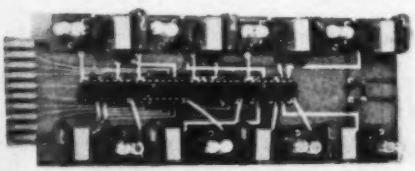
At Last . . . . . Repeater Sophistication Is HERE . . . . .

Now at a realistic price you can have "Touch-Tone" command functions, autopatch, and control. It's the Signal Systems Decoder.

12/16 BUTTON TOUCH-TONE DECODER

Uses NE-567 decoder IC's and 7402 AND gates. Frequencies are pot variable. Response times are fixed by capacitors. (200 ms. unless otherwise specified).
Outputs are ANDed TTL logic highs.
Requires: 5V

Board:		$10.00
Kit:	12 button –	77.00
Kit:	16 button –	88.00
Tested:	12 button –	85.00
	16 button –	98.00

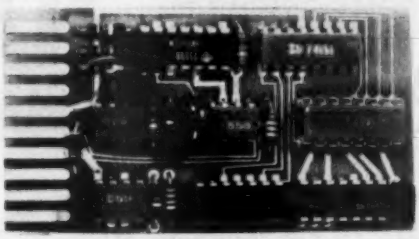


RTTY R-Y GENERATOR

Uses two NE-555 timers, 7420 and 7493 IC's. Outputs repetitive or clutched zero-bias test signals in Western Union format. Used to check printer range and aid proper adjustment. Requires 5 volts. Loop driver circuitry.

Board:	$ 1.75
Kit:	8.00
Tested:	11.00

THE IDENTIFIER TO END ALL IDENTIFIERS



CW/RTTY/REPEATER IDENTIFIER

Uses 8223 Programmable read-only-memory. NE-555 timers for clock, tone generator and 5 minute timer. Apply 5 volts (200mA) and COR (ground) and it outputs tone (5 VPP) and PTT (5V).
256 bit plug-in memory is programmed to your specifications or call.
Dits and element spaces = 1 bit.
Letter space = 2 bits.
Dash = 3 bits.
Word space = 4 bits.
Typical full memory: CQ FD CQ FD FD DE WAØVTU/Ø K
Can also be programmed to output up to 32 RTTY characters, 5 level Baudot, double stop. See ARRL Manual "FM and Repeaters" page 136.
For 5 minute timer and tone oscillator add $5.00 to Kit price and $6.00 to Tested Unit price.

Additional factory programmed memories:	$14.00
Board:	8.00
Kit:	25.00
Tested:	29.00

2 METER PREAMP

40673 or MFE3007 Dual Gate FET. Very small size–1 1/8 X 1 5/8 inches. 16 db. gain, 2.5 db. noise figure.

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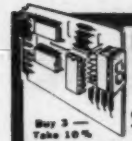

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READOUT	Char.	Maker
☐ MAN-1	.27 h.	Monsanto
☐ MAN-4	.19 h.	Monsanto
☐ 707*	.33 h.	Litronics
☐ 704**	.33 h.	Litronics
☐ SLA-1*	.33 h.	Opcoa

* Pin-for-pin MAN-1, ** Pin-for-pin MAN-4, elec. char. same.

HIGH POWER TRANSISTOR $1.49 WITH HEAT SINK

☐ 3 for $3

Removed from new equipment! Includes popular 2N174 'doorknob' transistor TO-36, germanium, PNP, 150 watts, VCBO 80V, 15 amps, 40 hfe. For ignition, high power transmitters, etc. Mounted on heat sink 5 x 2½ x 1¼".

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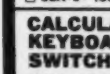
Your choice 3 for $7.50 **$2.98**

3PDT
☐ 12 VDC
☐ 115 VAC

Excellent for "HAM" use as antenna switching, latching, transmit, receive, etc., and 100's of commercial or industrial uses. Includes plastic dust-cover with diagram and hookup info, 11-pin plug-in base. Contacts movable gold flashed silver, stationary overlay, with silver cadmium oxide movables. All contacts 10 amp 3PDT. Coil data, 115VAC 2250 ohms, 17.5 ma. 12 VDC 21 mils 168 ohms. Size: 2¼" x 1 5/16". Wt. 4 ozs. Center pin missing. Comar Mfg. type equal too.



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Kit of 17 for $7.50

☐ 10-pc. kit, 0-to-9 only, same type as above. **3.50**

Each switch made by Oak #416, SPST normally open, 24V 1 amp contacts. Kit includes 0-to-9 (10 switches white with black numerals) decimal, white with black dot, and CE, CL and 4 functions blue with white characters.

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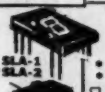
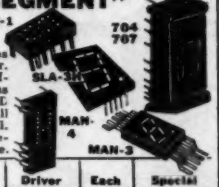
☐ 4-MV5054	Jumbo red lens, red lite	TO-18	$1.00
☐ 1-MV5222	Jumbo gren lens, green lite,	TO-18	1.49
☐ 1-MV5322	Jumbo yellow lens, yellow lite,	TO-18	1.98
☐ 4-MV5080	Micro red dome red lite,	TO-18	1.00



SLA-1
SLA-2

LITRONIX-OPCOA-MAN "7-SEGMENT" LED Readouts



MAN-1
704
707
SLA-3
MAN-4
MAN-3

All fit 14-pin IC sockets. All 7-segments. MAN Series "all LED" and made by well-known West Coast mfgr. Others Reflective Bar type made by OPCOA and LITRONIX. The Reflective Bar types are low-cost versions of the MAN's except .33 character height! If one LED blows you lose a segment. MAN's you DO NOT! All readouts 0-to-9 numerals, plus letters and decimal. **Opcoa and Litronix products pin-for-pin replacements for MAN-1 MAN-4. All 5V TTL compatible.

ALL LED READOUTS — TYPE	character Size	Color Display	Decimal	Mils	Driver	Each	Special
☐ MAN-1 equal	.27	Red	Yes	20	SN7447	$4.50	3 for $12.
☐ MAN-1A equal*	.27	Red	Yes	20	SN7447	4.95	3 for $13.
☐ MAN-3 equal	.115	Red	Yes	10	SN7448	2.50	3 for $6.
☐ MAN-3A equal*	.115	Red	Yes	10	SN7448	2.50	3 for $6.
☐ MAN-3M equal*	.127	Red	Yes	10	SN7448	2.50	3 for $6.
☐ MAN-3 equal	.115	Red	***	10	SN7448	1.95	3 for $5.
☐ MAN-3M equal*	.127	Red	Yes***	10	SN7448	1.95	3 for $5.
☐ MAN-4 equal*	.190	Red	Yes	15	SN7448	3.25	3 for $9.
☐ MAN-4 equal*	.190	Red	Yes***	15	SN7448	2.75	3 for $8.
"REFLECTIVE LITE BAR" (Segment LED Readouts)							
☐ 707** (MAN-1)	.33	Red	Yes	20	SN7447	3.25	3 for $9.
☐ 704** (MAN-4)	.33	Red	Yes	20	SN7448	3.25	3 for $8.
☐ SLA-1** (MAN-1)	.33	Red	Yes	20	SN7447	3.25	3 for $8.
☐ SLA-2 + − 1	.33	Red	No	15	SN7447	3.25	3 for $9.
☐ SLA-3H Giant	.70	Red	Yes	30	SN7447	6.50	3 for $18.
☐ SLA-11C** (MAN-5.33	Green	Yes	40	SN7447	5.95	3 for $16.
☐ SLA-12** ±1	.33	Green	No	40	SN7447	3.50	3 for $ 9.

* Red epoxy case, others clear. ** Litronix and Opcoa's pin-for-pin equals and electrical specs as MAN-1 or MAN-4. *** LED "dot" missing.

1" SQ MINI METERS

* Plastic case
* Red needle indicators

☐ Balancing, stereo, tape, amps. **$1.49**
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FACTORY TESTED
FACTORY GUARANTEED

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☐ 533 Micro power 709 (TO-5)	2.50
☐ 536 FET input op amp (TO-5)	3.95
☐ 537 Precision 741 (TO-5)	2.50
☐ 550 Precision 723 voltage reg. (DIP)	1.17
☐ 856 5 Times faster than 741C	2.10
☐ 858 Dual 741 (TO-5)	1.00
☐ 560 Phase lock loops (DIP)	3.25
☐ 561 Phase lock loops (DIP)	3.25
☐ 562 Phase lock loops (DIP)	3.25
☐ 565 Phase lock loops. (A)	3.25
☐ 566 Function generator (TO-5)	3.25
☐ 567 Tone decoder (A)	3.25
☐ 702C Hi-grain, DC amp (TO-5)	.49
☐ 703C RF-IF, amp, 14 ckts (TO-5)	1.00
☐ 704 TV sound IF system	1.50
☐ 709C Operational amp (A)	.49
☐ 709CV Op amp (mini DIP)	.49
☐ 710C Differential amp (A)	.49
☐ 711C Dual diff. comp (A)	.49
☐ 723C Voltage regulator (A)	.95
☐ 733 Diff. Video Amp	1.75
☐ 741C Frequency compensator 709 (A)	.49
☐ 741CV Freq. comp 709 (Mini DIP)	.49
☐ 747C Dual 741C (A)	1.25
☐ 748C Freq. adj. 741C (A)	.49
☐ 783 Gain Block	1.75
☐ 709-709 Dual 709C (DIP)	1.00
☐ 739-739 Dual stereo preamp	1.98
☐ 741-741 Dual 741C (A)	1.00
☐ PA265 5-Watt voltage regulator	1.98
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☐ SN7413	.95
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☐ SN7421	.55
☐ SN7422	.35
☐ SN7423	.50
☐ SN7425	.50
☐ SN7426	.30
☐ SN7430	.30
☐ SN7432	.35

☐ SN7437	.55
☐ SN7438	.55
☐ SN7440	.30
☐ SN7441	1.40
☐ SN7442	1.50
☐ SN7443	1.50
☐ SN7444	1.50
☐ SN7445	1.50
☐ SN7446	1.65
☐ SN7447	1.45
☐ SN7448	1.50
☐ SN7450	.30
☐ SN7451	.30
☐ SN7453	.30
☐ SN7454	.30
☐ SN7455	.55
☐ SN7460	.30
☐ SN7461	.35
☐ SN7462	.35
☐ SN7464	.30
☐ SN7470	.50
☐ SN7471	.55

☐ SN7472	.50
☐ SN7473	.55
☐ SN7474	.35
☐ SN7475	1.00
☐ SN7476	.65
☐ SN7478	.95
☐ SN7480	.65
☐ SN7481	1.25
☐ SN7482	.99
☐ SN7483	1.25
☐ SN7485	1.41
☐ SN7486	.50
☐ SN7489	4.50
☐ SN7490	1.49
☐ SN7491	1.35
☐ SN7492	1.35
☐ SN7493	1.35
☐ SN7494	1.35
☐ SN7495	1.35
☐ SN7496	1.35
☐ SN74106	.95
☐ SN74107	.70
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☐ SN74155	1.85
☐ SN74156	1.85
☐ SN74157	1.55
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☐ SN74160	1.95
☐ SN74161	1.95

☐ SN74163	1.95
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☐ SN74165	2.10
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☐ SN74175	3.20
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☐ SN74177	2.10
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January 1974

SUN	MON	TUES	WED	THUR	FRI	SAT
		1	□2	□3	□4	5
6	7	8	9	10	11	12
13	14	15	16	17	□18	□19
20	21	22	○23	□24	□25	□26
○27	□28	□29	□30	31		

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3	3	3	3	3	7	14	14A	14
ARGENTINA	14	7	7	7	7	7	14	14A	14	14	14A	14
AUSTRALIA	14	7B	7B	7B	7	7	3A	7	14	14	14	14
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	14
ENGLAND	7	3A	3A	3	3	3	7A	14A	14A	14	7	7
HAWAII	14	7B	7	3A	7	7	3	3	7B	14	21	21
INDIA	7	7	7B	3B	3B	3B	7	14	7B	7B	7	7
JAPAN	14	7B	7	3A	3	3	3	7	7	3A	7	7A
MEXICO	14	7	7	7	7	7	7	14	14	14A	14A	14
PHILIPPINES	14B	7B	7B	3B	3B	3	3	7	7	7	3B	7
PUERTO RICO	7	7	7	7	7	3	7	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	14	21	21	14A	14	14
U. S. S. R.	3	3	3	3	3	3B	7A	14	7A	7B	3B	3
WEST COAST	14	7	7	7	7	7	3	7	14	14A	21	14A

CENTRAL UNITED STATES TO:

ALASKA	14	7	7	3	3	3	3	3	7	14	14A	14A
ARGENTINA	14	7	7	7	7	7	7	14	14	14	14A	14A
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ENGLAND	7	3A	3A	3	3	3	7	14	14	14	7	7
HAWAII	14	14	7	7	7	7	7	3	7	14	21	21
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U. S. S. R.	3	3	3	3	3	3	3	7A	7A	7	3B	3B

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ALASKA	14	7A	7	3	3	3	3	3	7	7A	14	14
ARGENTINA	14	14	7	7	7	7	7	7A	14	14	14A	14A
AUSTRALIA	14A	14A	14	7B	7	7	7	3A	7	14	14	14
CANAL ZONE	14	7A	7	7	7	7	3A	14	14	21	21	21
ENGLAND	7	3A	3A	3	3	3	3	7	14	14	7B	7B
HAWAII	21	14	14	7	7	7	7	3	7	14	21	21
INDIA	7	14	7B	3B	3B	3B	3B	3A	7	7	7	7B
JAPAN	14A	14	7	3A	3	3	3	3A	7	3A	7	14
MEXICO	14	7	7	7	7	7	3	7	14	14	14A	14
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U. S. S. R.	3	3	3	3	3	3	3	3	7A	7	3B	3B
EAST COAST	14	7	7	7	7	7	3	7	14	14A	21	14A

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

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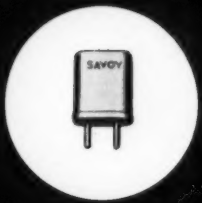

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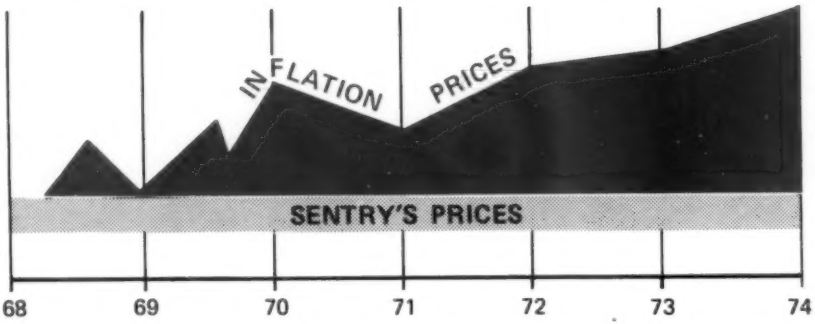

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